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THE ANTIQUITY OF ALCHEMY¹.

By H. E. STAPLETON.

Introduction.

CHANGE of occupation—as many of us may have had the good fortune to realise—is one of the finest Elixirs of Life : and when—after spending five years herding cattle, while invaders were endeavouring to turn the island in which he lives into a Gibraltar of the Channel—the writer took up again the studies that had been his chief interest since the beginning of the century, the world, and its historic problems, seemed all the fresher and more intriguing from their having been put aside for so long.

One thing, on reflection, appeared more curious than any other, and that was the failure of at least one leading historian of Alchemy during the years between the two World Wars to realise either the complexity or the possibilities of the chemico-technical panorama of the past. Hypnotised, it may be, by the rapidity with which modern science is extending our own mental horizon, and ignoring the almost certain existence of some degree of scientific knowledge

¹ This paper was one of those discussed in the Chemical Section (Group II) of the VIth International Congress of the History of the Sciences that met on 14–21 August 1950, at Amsterdam. The writer desires to acknowledge the helpful criticism of friends who have since read the typescript, especially Sir Leonard Woolley, Prof. Homer H. Dubs of Oxford, Dr. G. P. Lewis and Mr. I. R. F. Calder. Needless to say, they cannot be held responsible for any of the conclusions that have been reached ; but their comments have led to occasional verbal modification of the original text, as well as the deletion of certain unnecessary passages. H. E. S. (15th August, 1951).

among the subjects of the great dynasties of the pre-Christian East, the writer in question seemed to suggest that the chemical data recorded by Ar-Rāzī and other Muslim writers of the 10th and 11th centuries A.D. must have been discovered in the century prior to A.D. 900.

Such an attitude of thought—with its implied strict limitation of objective—might, if generally accepted, have seriously handicapped subsequent enquiry : and in any case, it led to at least two conclusions that are, possibly, quite unwarranted. The first concerns the great Muslim alchemist Jābir ibn Ḥayyān Aṣ-Ṣūfī, who, apparently—after a brief association with the 6th Shi'ite Imām Ja'far Aṣ-Ṣādiq, before the latter's death in A.D. 765—served as Court Alchemist to the Caliph Harūn ar-Rashīd, under the powerful patronage of Harūn's ministers, the Barmacides of Balkh and Baghdad. This outstanding character was declared to be an entirely mythical person, invented by Ismā'īlīs in the 10th century.

As for the still more clearly authenticated story that Ja'far's close relation, Khālīd ibn Yazīd, was the first Arab to take up the study of alchemy, not the least effort was made to study seriously the Arabic treatises ascribed to Khālīd that are available for study not only in India, but also in Egyptian and European libraries. Having once dogmatically stated that it was absurd to imagine that any son of a 7th century Commander of the Faithful could possibly have taken any interest in alchemy, it was necessary to ignore the strong probability that a man whom An-Nadīm, the 10th century author of the *Fihrist*, seems to suggest had something to do with the first steps that were taken to keep the State accounts in Arabic (instead of Persian), might have been sufficiently attracted by the claims of alchemists that they could transmute base metals into Gold, to have had some of the current treatises on the subject translated for his information. That this was actually done will be evident from the following additional statement by An-Nadīm in the *Fihrist* ² :—

Being himself a scholar, he (Khālīd ibn Yazīd) was greatly interested in the Sciences. He was particularly attracted to the Art (of *Kīmīyā*) : so he ordered some Greek philosophers who lived in the city of Miṣr (Cairo), and who had a good knowledge of Arabic, to be summoned, and instructed them to translate the books on the Art from the Greek and Coptic languages into Arabic. This was the first translation from one language into another in Islam.

In view of the trustworthy character of An-Nadīm as a bibliographer, the remarkably tolerant attitude of Muslims towards Christians (and *vice versā*) during almost the whole of the 1st century of Islam ³, and the certain availability in Egypt at the time indicated by An-Nadīm (i.e. c. A.D. 700) of alchem-

² Vide *The Seventh Discourse on Philosophers and the Ancient Sciences, and on the Books written on this subject.* (Fluegel's ed., p. 242.)

³ As some indication of the relations that were maintained in the life-time of Khālīd between Muslims and Christians on the one hand and Islām and Byzantium on the other, the case of the Great Mosque at Damascus may be mentioned. This Church of St. John

ical treatises dating from the time of Zosimos (c. A.D. 300) or even earlier, the alchemical works ascribed to Khālīd that still survive in Arabic obviously deserve careful study. Even more desirable is the consideration of the many treatises that bear the name of Jābir as author, which are also enumerated by An-Nadīm: and this task was begun 20 years ago by Paul Kraus, one of Dr. Ruska's pupils.

As every student of the two massive and thought-provoking volumes⁴ that Kraus was able to publish in Egypt before his tragically premature death will realise, the torch of Kraus's acute mind was the first to throw any clear light into the jungle of Ismā'īli-infected documents that make up the Jabirian *Corpus*. Comments on almost every page of Kraus's text suggest themselves to the reader, and every chapter will doubtless, sooner or later, inspire historians of science to further attempts to solve the many problems that still await solution. It was indeed difficult to decide what Kraus himself—if he had been alive—might have chosen for discussion at the Amsterdam Congress: but it soon became evident to the present writer that the choice of subject should be within the ambit of Kraus' greatest achievement, viz. his proof that much of the Jabirian *Corpus* that is still available for study in Arabic MSS. must have been either revised, or, in some cases, even compiled by free-thinking Shī'ites of the Ismā'īli sect during, in all probability, the 50 years between A.D. 900 and 950.

Now, as everybody who has studied the history of either philosophy or science in the East is aware, the East—though, in all probability, civilisation originated within its borders—has, until quite recently, been content to dream for 2,000 years of its past glories, seldom inventing anything new, but only adapting to changing conditions knowledge or ideas passed on from previous generations. The fact that the greater part of this alchemical *Corpus* which we are considering received its present shape in the first half of the 10th century—far from suggesting that the theories and facts contained in it were products of 10th century Arabic or Persian thought—should rather incite students to discover, if possible, the earlier authorities from which the Jabirian material was drawn. This Kraus himself undoubtedly realised, as is shown by his discussion

the Baptist was built by the Roman Emperor Theodosius in A.D. 369 on the site of an ancient pagan temple, and, up till the time of the Caliph Walīd I, was used by both Christians and Muslims for worship.

When, in A.D. 708, the Caliph decided to reserve it for Muslim worship, and had it converted into the present Mosque, the mosaic work was executed by Byzantine artists supplied to Walīd by the Greek Emperor himself. Possibly they were the same artists whom Walīd had employed during the previous year for covering the exterior of the Mosque of 'Umar at Jerusalem with mosaics (see H. Saladin, *Manuel d'Art Musulman*, 1907, I, pp. 56, 80 and 85). The Emperor in question was Justinian II, who had been restored to the Imperial throne in A.D. 705.

It was from the pulpit of the old church, before its conversion into a mosque, that the then youthful Khālīd ejected, in A.D. 684, the riotous Dhahak (cf. Aṭ-Ṭabarī—de Goeje's ed., p. 471).

⁴ *Jābir Ibn Ḥayyān*. (Cairo: French Institute Press—Vol. II, 1942: Vol. I, 1943.)

of the Arabic treatise 'The Secret of Causes and Creation', to which the name of Apollonius of Tyana (1st century A.D.) was attached, and which seems to have been either compiled, or translated from some earlier Syriac text, early in the 9th century: but neither this, nor any other among the many treatises consulted by Kraus, afforded much help in explaining the 'Theory of Balance' on which the contents of the Jabirian treatises are based: viz. why a certain sequence of Numbers 1, 3, 5, 8, with its total of 17, as well as the Number 28, were adopted in the 'Books of the Balances' to express the basal structure not only of Matter, and of every science then recognised, but even of the language whereby men endeavour to express their dreams and ways of thought.

The present paper is an attempt to carry on Kraus' work a stage further by suggesting a possible solution of this problem that Kraus left unsolved, and to indicate the fundamentally important historical consequences that would appear to follow, in the event of such an explanation being accepted, after further discussion, as correct.

*Kraus's Classification of the most important Groups of Treatises
contained in the Jabirian Corpus.*

To enable students to form some idea of the immensity of the task which Kraus undertook, one need only mention the fact that, in his first volume, at least 1,000 titles of works in the *Corpus* have been catalogued: but, for the purpose of this paper, it is only necessary to give a brief summary of the contents of four of the chief groups of documents.

Apart from the *Kitāb ar-Rahmah*—Book of Pity (or, as it is sometimes called, *K. al-Uss*—Book of the Foundation) which is admittedly earlier than all the other treatises ascribed to Jābir, and which—in a Hyderabad MS.—is stated to have been found under Jābir's pillow when he died at Tūs in A.H. 200 (i.e. A.D. 815), these are, in rough chronological order:—

I. The CXII Books ⁵.

The individual treatises of this great collection may be said to be concerned chiefly with the actual methods employed in the Alchemical Art, while the materials that are favoured appear to be, with certain exceptions, organic in origin. The underlying theory in most of the 28 books that have survived is the reduction of 'Bodies' to the four 'Elements' Earth, Water, Air and Fire, and of the 'Elements' to the 'Natures', viz. the individuals comprising the two pairs of normally opposite qualities—Heat and Cold, Moistness and

⁵ This title probably had arithmological value to Jābir, as 112 breaks up into 28×2^2 , and 28 is the second Perfect Number that appears in the Books of the Balances in place of 60—the sexagesimal unit employed in at least one Syriac treatise that may have served as a 'source-book'. A Perfect Number is one which is equal to the sum of its factors smaller than itself. The first is 6 ($=1+2+3$), and the third 496. The other factor of 112, viz. 4, may also have had some significance to Jābir, as it is the number assigned to Hermes (*vide* 1946 *Encycl. Brit.* article) in his original aspect as the Greek god of Fertility. For more about 28, see later, pp. 5 (n.), 7 and 14.

Dryness. The would-be alchemist must also be able to bring about the requisite combination, in their proper proportions, of 'Body', 'Soul' and 'Spirit', and know how to conduct the two principal Operations, viz.:—*Barrānī* (Exterior) and *Jawwānī* (Interior).

Some of the treatises are dedicated to Jābir's patrons, the Barmacides, or people connected with them: while his actual teachers that are mentioned include the Imām Ja'far aṣ-Ṣādiq; one Harbī—variously described as 'Of Yamen', or 'The Himyarite'; an anonymous Monk—a disciple of Marianus, the teacher of Khālid ibn Yazīd: and finally, a person with the curious title of 'The Donkey-Eared Logician'. Except in the 56th treatise (*K. al Mujarradāt*—Book of Extracts), which purports to be a summary of the whole collection and contains numerous alchemical receipts ascribed to Socrates, Porphyry, Zosimos, Pythagoras, Hermes, Democritus, Aristotle and other supposed alchemists, few references to ancient alchemical writers occur: and—except for very occasional references to the 'Books of the Balances' (which are almost certainly glosses by copyists)—there is no mention of the 'Theory of the Balance' that characterises a later portion of the *Corpus*.

The entire collection may be described as a detailed expansion of the first three books *Kutub Uṣṭuqus al-Uss* (Treatises on the Element—στοιχεῖον—of the Foundation), dedicated to the Barmacide Ministers of successive Caliphs during the last quarter of the 8th century A.D.: and these three in turn are based on the 'Emerald Tablet' of Hermes that appears first in Arabic as an appendix to the early 9th century work *Sirr al-Khalīqa* (Secret of Creation), ascribed to Apollonius of Tyana—the 1st century Maker of Talismans.

II. The LXX Books ⁶.

Three MSS. of this Collection are known. Of these, Kraus's Table (I, pp. 41–2) show that the Jārullāh MS. of Istanbul is complete (except for the 45th treatise), while the other two (T. Taymūr, Istanbul: and N. Cairo) are more or less defective. A translation into Latin by Renald of Cremona—made in the 12th century—exists in various MSS. and has been published by Berthelot (*Mém. de l'Acad. des Sciences*, 1906, XLIX, pp. 310–63). Ruska also published a detailed description of the entire work (based on MSS. T. and N.) in his *Die Siebzig Bücher des Gābir ibn Ḥajjān* in the 1927 *Festgabe* for von Lippmann.

The 'Seventy Books' are divided into seven sections—each of which comprises ten treatises: and, unlike the 'CXII Books' which form a coherent whole, the only link between the constituent treatises is the principle of the 'Dispersion of Knowledge', according to which a single topic was discussed at great length in each treatise, but the problem of what conclusion should be

⁶ This title may refer to the need for redistilling 70 times the Oil produced by the heating over a Water Bath of the animal substances that were used in making the Elixir. Alchemical Distillation in general was repeated in accordance with the numbers 49 (i.e. 7²); 70 (i.e. 7 × 5 × 2), and 700 (i.e. the product of the Perfect Number 28, and 5²).

reached was apparently left to the disciple himself to decide. In addition to many references to the individual treatises of the 'CXII Books' as well as to the *K. ar-Rahmah*, occasional—possibly interpolated—allusions are found to minor collections of his writings, such as the 'Ten Books supplementary to the LXX' (of which only one treatise—dealing with the different 'paths' for preparing the Elixir from Mineral substances—has survived), as well as to most of the individual treatises comprising the collection known as 'The Seventeen Books', whose titles occur in the *Fihrist*, though none of them have been traced as still existing in any library. Among the Greek writers on alchemy we find—in addition to several of those already mentioned—the names of Plato, Agathodaimon, Ariyūs, Galen and Andriyya. Ja'far and Harbī are each only mentioned once. Two laudatory references also occur to Apollonius of Tyana's *Sirr al-Khaliqa*—the treatise which many of the later books of the Jabirian *Corpus* claim as one of their principal authorities.

The contents of these seven Decades show a somewhat greater tendency to utilise mineral substances than is evident in the CXII—especially in the last Decade.

III. The Ten Books of 'Rectifications' (*Musāhḥahāt*).

These apparently were written to show what improvements in technique or theory were made by different alleged alchemical writers—Pythagoras; Socrates; Plato; Aristotle; Archigenes (two books); Homer⁷; Democritus; Harbī; and finally Jābir himself. Unfortunately, none has survived in MS.; but their probable contents can be guessed from a Commentary (on the 3rd in the series) by a Moroccan writer of unknown date. From Kraus's annotated translation of a portion of this work (II, pp. 48–51) Plato is seen instructing Timaeus in the alchemical knowledge he himself had professedly received from Socrates: and details of 90 operations (all involving the 'Spirit' called Mercury) are given, with comments on each of them by Jābir. First a text from the Ps. Plato is quoted, then Jābir's interpretation of it, and, finally, a detailed description is given of an alchemical operation. The most perfect apparatus is that constructed on the model of the World. Three references to treatises of the CXII Books occur: but only one other Jabirian treatise (viz. one included in the XX Books that follow next in the *Fihrist*) is mentioned.

IV. The Books of the Balances (*Kutub al-Mawāzīn*).

This collection consists of 144 Treatises⁸, devoted to discussions on the Theory of the Balances. This, in brief, is that Alchemy, Astrology, Medicine,

⁷ Possibly only with reference to certain Greek arithmological ideas that were supposed to be found in the Iliad and Odyssey (see *infra*, note 8).

⁸ The author (or authors) of the Jabirian *K. al-Khāwaṣṣ al-Kabīr*—parts of which may be earlier than the Books of the Balances and other parts more recent—explains this total with reference to a passage in the Odyssey about the Danaoi (*cf.* Kraus, II, p. 118, n.): "Homer says that Fourfold things that possess three aspects represent the elements (lit. 'mothers') of knowledge. He has shown by this the wonders connected

Physics, Music, Astronomy, Grammar and Prosody are all based in the main on the numbers 1, 3, 5, and 8, with their magic total of 17, which indicate the balance of relationship between the Four Natures, Heat, Cold, Moistness, and Dryness, that must be maintained in the case of every phenomenon that presents itself to the human intellect. Though this portion of the theory is ascribed to the 1st century A.D. Apollonius of Tyana, it is not apparently traceable in the *Sirr al-Khalīqa* (Secret of Creation) that bears Apollonius's name as author, but may possibly have been drawn from some earlier Syriac treatise ascribed to him⁹, as the Jabirian writer repeatedly quotes Apollonius as his authority. Instead, however, of accepting Apollonius's other basal number of 60—which clearly indicates that the ideas in question were connected with the primitive sexagesimal system of ancient Eastern numerology¹⁰—the author (or authors) of the *K. al-Mawāzīn* substituted the second 'Perfect Number' 28, on the authority of an alchemical treatise ascribed to Socrates¹¹.

with $4 \times 3 = 12$, and that when this number is multiplied by itself, it gives 144. This comprises within itself the (ideas of Square) Root, Division, Multiplication, and Algebra. If, in the sciences, you wish to attain your desire, you must study Geometry."

In this connection, it may be noted that if 144 is divided by 2, the product is 72, which is a most significant number among both Zoroastrians and the ancient Chinese. As Browne pointed out (*Literary History of Persia*, I, 99), the *Yasna*—the oldest liturgical division of the Zoroastrian scriptures—has 72 Chapters, and this number is repeated in the 72 strands of the *Kushti*—the initiation girdle of the young Zoroastrian. Similarly, in ancient China, the year was divided into 5 seasons, each of 72 days: and to each of the Seasons, one of the Chinese Elements was allotted as follows:—

- | | |
|----------------------------|--------------------|
| 1. Spring : Wood. | 4. Autumn : Metal. |
| 2. Summer : Fire. | 5. Winter : Water. |
| 3. Central Season : Earth. | |

In addition, Granet (*Danses et Légendes de la Chine ancienne*, I, 358, n. 1) notes that the first 36 days of Spring and 36 days of Winter were called 'Gates' through which, during this total period of 72 days, communication was supposed to take place between Heaven and Earth. Men and women came at this time under the influence of Heaven's creative spirit.

⁹ E.g., 'The Book of the Seven Idols'—dealing with the seven Metals and seven Planets—on which al-Jildakī wrote a Commentary in his *K. al-Burhān*. The name (and contents) suggests that it was of Harranian origin.

Kraus (II, 297, n.3) may have been too sceptical in dismissing as 'une fiction littéraire' the statement in a Berlin MS. of this work that it was translated into Arabic in the time of Khālid ibn Yazīd. Another even earlier date for such a translation being made is that mentioned in a Rāmpūr Arabic MS. of Six Books of Zosimos: "during the Governorship [over Syria] of Mu'āwiya ibn Abī Sufyān in the 2nd *Rabī'c* of A.H. 38" (i.e. A.D. 659). See Stapleton and Azo, *Mem. A.S.B.*, 1910, III, p. 67.

¹⁰ E.g., the earliest estimate of 360 as the number of days in the year, and the same number of degrees in the circle of the ecliptic. It was the basis of the sexagesimal and duodecimal systems of counting—the last of which we still cherish by making our children continue their mathematical tables up to Twelve times Twelve.

¹¹ Kraus's idea (II, 58) that it is impossible to believe that any ancient writer could have ascribed alchemical writings to Socrates might have been modified if he had known the contents of the Āṣafiya Library MS. *K. at-Ṭūbā*—which purports to have been written by Al-Azdī, a friend of Khālid ibn Yazīd. In this, only Greek, Persian, Egyptian,

The further attribution to the Natures (in their quality of Sectors in the 'Circle of Existence') of a succession of Powers is—as Kraus points out—undoubtedly based on the pharmacological theories of Galen (A.D. 130–200): but instead of Galen's four Grades of Power, Jābir has seven. Moreover, Jābir assigns to both the 1st Nature, or 'Degree', and the 1st Power, the same Perfect Number 28. The numbers attached to the remaining three Degrees follow the *ascending* order 84, 140, and 224, whereas those of the Grades 2–7 *descend* in the order 21, 15, 10, 6, 3, and 1.

The assignment of 28 as the first number in each series may of course have been an arbitrary selection of a Perfect Number, and this may also explain the series of Powers, the total of which is 28×3 . Kraus points out that the numbers assigned to the four Degrees correspond to the series 1 : 3 : 5 : 8, with a total of 17; but no satisfactory explanation could be found as to why the writer of the *Kutub al-Mawāzin* chose to allot these numbers to the Natures or Elements, in preference to those used by the other Schools of alchemical thought that will be found catalogued on pp. 16 and 17 of Kraus's Vol. II ¹².

As Kraus suggests, it is just possible that this curious total 17 may be an echo of Pythagorean discussions on (*a*) why there were 17 consonants (and 7 vowels) in the Greek alphabet, and (*b*) on the division of the hexameter by the caesura into two parts, one with nine and the other with eight syllables. If the Stoic philosopher Posidonius (135–51 B.C.) really taught that the human soul is made up of 17 pairs or faculties, this may have helped Jābir to regard the series 1 : 3 : 5 : 8, with its total 17, as ordained by—as well as an image of—the World Soul. Pythagorean interest in the number 17 is also apparent from

Jewish and Byzantine alchemists are mentioned, and among them appears 'Buqrāt (or Buqrātīs) the Sage, teacher of Aflāṭūn'. It was probably this (or some similar) treatise that led Jābir to refer so extensively to Socrates, Plato, Aristotle and other Greek philosophers as alchemical authorities. Seleucid Syria may be regarded as the likeliest place of origin for such pseudographic compositions, one of which was certainly in existence in A.D. 300 as a quotation from some alchemical treatise by Buqrāt is found in the Cairo Library Arabic MS. translation of a treatise by Zosimos. See also the extracts given by Ibn Umail from some alchemical treatise ascribed to Socrates, of which a translation will be found in *Mem. A.S.B.*, XII (pp. 130–2). The extraordinary resemblance of the phraseology of these extracts to that found in the treatise of Agathodaimon (discussed later in this paper) suggests, in fact, that some phases at least of Jābir's 'Socratic' alchemy may represent the alchemy actually practised by the Harranians. In the absence of the original Greek texts, the Arabic and Latin alchemical texts ascribed to Socrates should be examined for their possible relationship with Ibn Umail's quotations; the contents of Agathodaimon's treatise; and—with even greater possibility of estimating the actual extent of Harranian Science—Ar-Rāzī's alchemical treatises.

¹² Incidentally, by way of proof that the *Jabirian Corpus* is a composite production, it may be noted that in the LXX Books (from which these lists of Schools were derived) the series 1 : 4 : 5 : 8, with a total of 18, is adopted, instead of the series 1 : 3 : 5 : 8 employed in the Books of the Balances. As Kraus has proved, these last—in their present form—must have been composed about A.D. 950: and it is not, therefore, surprising that no reference to the Theory of the Balance is found in any of Ar-Rāzī's treatises.

a statement in Plutarch's essay on ' Isis and Osiris ', that as Osiris died on the 17th of the Egyptian month Athyr (Full Moon day), the Pythagoreans gave a special name to this day and generally regarded this number 17 with reverence.

Kraus's final conclusion runs as follows (II, p. 220) :—

Si nous ne sommes pas parvenu à résoudre toutes les difficultés qu'offrent les textes jabiriens, nous pouvons pourtant considérer comme certain que le fond des spéculations arithmologiques de Jabir remonte en dernier lieu aux théories de l'ancien pythagorisme et à la cosmologie du Timée.

It is difficult, however, to believe that Kraus felt quite so certain as this sentence would suggest, especially as, after quoting a few more instances of the occurrence in religious circles, ranging from St. Augustine's explanation of 153 fishes of the New Testament (as being a triangular number with 17 as its base)¹³, to the title ' Fifty-One ' of the present-day Isma'ili leader, the Aga Khan, he concludes the Section by a reference to the Nusairi tradition of the 51 Elect—17 from Iraq, 17 from Syria, and 17 of unknown origin—who stand at the gate of the city of Ḥarrān, to receive the just who will inhabit Heaven. The mention of this town, whose importance in the dissemination of knowledge in ancient time has previously been discussed by the writer¹⁴, is an indication that possibly Jābir's ideas originated from sources even older than the theories of Pythagoras, and from a different locality than the Mediterranean basin. It may also be noted that, according to the *Ikhwānu-ṣ-Ṣafā*, Pythagoras himself was a Ḥarrānian : which may be interpreted as a 10th century tradition that he had visited Ḥarrān, in search of knowledge, not obtainable in Egypt in the 6th century B.C.

The Source from which the Basic Numbers that are employed in the ' Books of the Balances ' were derived.

If Kraus was unable to discover the reason why so much importance was attached to the sequence of numbers totalling 17 by the author of the section of the Jabirian *Corpus* that can be assigned with considerable certainty to the first half of the 10th century, it seemed unlikely that any clue could have escaped his notice. On the other hand, in view of the secrecy that has always pervaded alchemical writings, such a clue is certain to be far from obvious ; and the only certain premise is that the clue must have some numerical connection. This condition is fulfilled by the Magic Square made up of the first nine numbers that is mentioned in Jabirian treatises as being of talismanic efficacy in connection with childbirth. In view of the embryological parallels that are constantly drawn in Hermetic writings between the birth of a child, and the production of the Elixir, this reference seemed worth following up : and

¹³ Actually, St. Augustine pointed out in his *Tractate CXXII on St. John's Gospel* that 153 is the sum of the digits 1 to 17 (quotation in Bullinger, *Number in Scripture*, p. 274).

¹⁴ Stapleton, Azo and Husain : ' Chemistry in Iraq and Persia ' (*Memoirs As. Soc. Bengal*, 1927, VIII, pp. 340-3 and 398-404).

as no previous enquiry appears to have been made why such a Square occurs in the *Corpus*, General E. Cazalas' volume *Carrés Magiques au Degré n*. (Paris, 1934) was consulted with a view to ascertaining whether this Magic Square could furnish any explanation of the series of numbers 1, 3, 5, 8 upon which the author (or authors) of the later portion of the *Corpus* considered everything perceptible by the human intellect was based.

Cazalas' treatise deals with the mathematical theory governing the construction of the first nine of these squares: but happens also to be illustrated by reproductions of almost the first Magic Squares¹⁵ to appear in print in Europe, viz. those given by Cornelius Agrippa—an older contemporary of Paracelsus—in his 1533 Cologne edition that was published under the title *De Occultā Philosophiā Libri Tres*.

Cazalas himself makes little comment on these reproductions: but in the 'Historical Introduction' by Aubry, the following passage is found:—

Cornelius Agrippa (*De occultā philos.* 1533) en fait connaître sept, ceux de 3 à 9. Il les donne *in abaco* (en chiffres arabes) *et in notis hebraicis*, et les appelle *tabulae Saturni, Jovis, Martis, Solis, Veneris, Mercurii, Lunae*, ou encore *mensulae planetarum*, d'où les noms de *tables* ou *carrés planétaires*, sous lesquels on les a parfois désignés. Même ceux écrits en chiffres arabes le sont de droite à gauche, ce qui témoigne de leur provenance sémitique. Il ne donne aucune explication sur leur mode de construction et indique seulement ce qu'il appelle leur *character* par un graphique de grimoire [incompréhensible graph], qui n'est interprétable, au point de vue de la construction, que pour le carré de 3 et les pairs. Il s'étend surtout sur leurs propriétés cabalistiques et talismaniques, et nous apprend qu'on devait les graver sur des lames ou disques de métaux divers, suivant les planètes (voir les vignettes).

On reading this paragraph, the first point to strike the writer was the fact that the order in which the metals etc. were arranged was that adopted by the Ḥarrānians of Mesopotamia in the 9th century A.D.¹⁶ Nothing is known for certain as to the source from which Agrippa derived his information, though it is likely that these Magic Squares were first made known to Europe by the 14th century Byzantine grammarian Moschopoulos. Similar squares to most of those given by Moschopoulos are referred to by Paracelsus as *sigilla planetarum*: and the same order of connection between the metals and heavenly bodies is found in the Arabic writings of the 9th century Persian astronomer Abū Ma'shar¹⁷. In view of the prominence given in the list to Lead—the metal

¹⁵ A Magic Square is defined by Cazalas as an arrangement of n^2 Numbers on a Chess-board containing the same number of divisions, in such a way that the total of the numbers is the same in each horizontal or vertical line, and in each of the diagonals of the Square.

¹⁶ *Vide, Mem. A.S.B.*, 1927, VIII, pp. 398–404.

¹⁷ *Vide Mem. A.S.B.*, 1927, VIII, p. 403 (notes). The Ḥarrānian order of the metals continued to be used in Abū'l Qāsim al-'Irāqī's *Al-Kanz al-Afkhar*, written towards the latter end of the 13th century but based on some treatise by an alchemical writer of a century earlier. (*Cf. E. J. Holmyard: Isis*, 1926, VIII, 3, pp. 417–21.)

which, in its molten state ($\chiύμα$), probably served as the starting point in many alchemical operations¹⁸, and as, moreover, the 9-Square was also associated in Arabic MSS. with the name of the 1st century Apollonius of Tyana, it seemed desirable to subject at least the first two Magic Squares, given by Agrippa as being associated with the metals lead and tin, to further analysis.

SATURN (=LEAD)¹⁹.

It will be seen that the total in any direction of each column of numbers—as well as of both diagonals—is 15 (i.e. 5×3): while the numbers on the circumference of the square—round the central 5—total 40 (i.e. 5×2^3)²⁰. The basal number of this square is therefore 5, which suggests some connection with the

Furthermore, it seems possible that the *original* Jabirian classification of the metals may have been that used in Ḥarrān, as, in the Tehrān MS. of the 'Books of the Seven Metals', they are arranged in this order, except that the Ḥarrānian Mercury is replaced by *Khārṣīnī*—the Chinese metal that was 'almost unprocurable' (see Kraus, I, p. 111). This is confirmed by the same order being found in the list of Metals, quoted by Kraus on p. 2 of his second volume, from the 32nd treatise of the LXX: as well, probably, in the arrangement (corrected) of the Jabirian treatises on the Planets found in the *Fihrist* (see Kraus, I, pp. 73–4).

¹⁸ For evidence of this belief in Egypt from at least A.D. 300 (and probably much earlier) see the quotation given by Festugière (*La Révélation d'Hermès Trismégiste*, p. 234) from one of the 35 Chapters of Zosimos to (Th)eosebeia: "Democritus called the four 'Bodies', Copper, Iron, Tin and Lead, Substances. All these are used in (making) the Two Tinctures (for Gold and Silver). All substances are regarded by the Egyptians as originating from Lead alone: for it is from Lead that the other three Bodies are derived." Festugière suggests that what is referred to in these 'Democritean' treatises as "Our Lead" may have been Antimony. The references in the same treatises to the Persian Ostanēs—whose name A. Mazaheri (*Archives*, July 1949, p. 987, n. 3), would equate to Usadhan, the favourite pupil of Zoroaster—suggest that, during the first occupation of Egypt by the Achaemenian Kings of Persia from 525 till the advent of Alexander in 331 B.C., Iranian theories on the constitution of matter and transmutation of the metals may also have been added to whatever ideas on these subjects were then current in Egypt.

In the *Kanz al-Afkhar* (Holmyard, *idem*, p. 418) one of the names given to Lead is *al-Ruḥ al-Jāmid*—the 'Solidified Spirit'. Lead was, therefore, believed in later Islamic times to be a valuable source from which the pure 'Spirit' in Gold could be obtained. Two other significant names of Lead in this list are: 'The Black Sulphur': and 'The Wazīr of the Sun' (i.e. 'The Minister of Gold').

¹⁹ On p. 33 of the Cairo ed. of Al-Būnī's *Shams al-Ma'ārif* (written about A.D. 1200—copy kindly lent by Prof. Arberry) this is called 'The Square of 'Izrā'īl', i.e. the Muslim Angel of Death. Similar names are assigned to the other Squares.

As pointed out in I. R. F. Calder's 'Notes on Magic Squares' (*Journ. Warburg and Courtauld Institutes* 1949, XII, 3) the total numerical value of the three letters Z, H, and L that make up the Arabic name *Zuḥal* for Saturn ($7+8+30$) is the same as that of the numbers forming this Magic Square, viz. 45. This may, however, be only a coincidence as the Arabic names for the Planets assigned to the other Squares do not bear any numerical relationship to the totals of the numbers forming these Squares.

²⁰ *Vide* also Appendix A for the possible connection of this simplest Magic Square with the Pythagorean Pentagram.

Pythagorean idea of 5 symbolising Marriage, viz. : between the First Masculine number 3 and the First Feminine number 2.

Furthermore, inspection shows that there is complete balance round the central 5—the numbers in each of the four sides totalling 15 (i.e. 5×3), while the total of the Male and Female numbers, is in each case 20, i.e. 5×2^2 .

Comprising the numbers 1–9.

3^2

4	9	2
3	5	7
8	1	6

Mathematically, the Square represents the central figure 5, as sited within 5×2^3 enclosure.

The 9-Magic Square seems to have been known to the 3rd century Neoplatonist Theodorus of Asine, as he assigned the following numbers to the elements ²¹ :—

Water	9	Fire	11
Earth	7	Air	13

If we read the peripheral numbers of the Square clock-wise, starting from 1, and adding each adjacent pair of numbers, we obtain $1+8=9$, $3+4=7$, $9+2=11$ and $7+6=13$, i.e. Theodorus's 'Element Numbers'.

This Magic Square must therefore have been known in the Near East in the time of Theodorus's teacher Porphyry (A.D. 233–305) and adopted by Theodorus to explain the constitution of the Elements on Pythagorean lines of Musical Harmony. By adding to the total of these numbers (40), the number of the celestial bodies (15), he obtained the number 55 (i.e. $1+2+3 \dots +10$) which he regarded as the total number of the Spheres. For further details of his 'extravagant speculations', including the statement that the 4th letter of the Greek word for Soul corresponded to the number 8 (i.e. 2^3), cf. Kraus, II, p. 219.

The 9-Square having been, for some reason, assigned to Lead, it is not difficult to understand how—provided other Magic Squares could be constructed bearing some numerical relationship to the first Square :—

- (a) these other Squares must inevitably have been allotted to the remaining metals ; and
- (b) these metals came to be regarded by alchemists as the children of Lead.

²¹ Kraus, *op. cit.*, II, p. 219. See also later (Summary, p. 37) for the use by Christians, late in the 2nd century A.D., of a 25-celled Magic Square, in which Letters took the place of Numbers.

JUPITER (=TIN).

Magic square made up of the numbers 1-16 ²².

4²

1	15	14	4
12	6	7	9
8	10	11	5
13	3	2	16

Total of each column in any direction—as well as of both diagonals—is 34 (i.e. 17×2) ; while that of the circumferential numbers is 102 (i.e. $17 \times 3 \times 2$).

Quite apart from the number 17 that we are looking for being the basis of both totals, further analysis discloses that 34 is also the sum of :—

- (1) The four numbers at the corners of the whole outer square ;
- (2) The numbers comprising the inner square ;
- (3) The opposite pairs of numbers round the inner square, i.e. between the corners of the outer square ; and, finally,
- (4)–(6) The total of each of the four squares that make up the larger square is 34.

This Magic Square is, therefore, an outstanding example of a completely symmetrical arrangement of groups of numbers round a central point.

Now it is well known that the Pythagorean community attached considerable importance to the *Gnomon*, or carpenter's rule—the L-shaped border, by the subtraction of which a higher square was converted into the next lower one. Let us, therefore, see what results are obtained by the application of the *Gnomon*, first taking the case of the 16-Square (representing Tin) that we have just been considering, and then the 9-Square (representing Lead).

The total of the numbers comprised within the 1-4-16 *Gnomon* of the 16-Square is 64 (i.e. 2^6), while that of the numbers within the residual square is 72 (i.e. $2^3 \times 3^2$). No deduction seems to follow from this method of analysis of the 16-Square except that the totals of the numbers in the sectors into which the square has been divided can be expressed in powers of the simplest

²² Al-Būnī (*op. cit.* p. 33) calls this the Square of Isrāfīl—another Muslim Angel of Death.

Pythagorean numbers. In fact, the application of the *gnomon* in this case would seem to be superfluous, in view of what has already been noted, viz.:—that mere inspection of the Square shows that its basal number is 17.

In the case, however, of the 9-Square, the value of this method becomes immediately apparent. The *Gnomonic* total is seen to be 28, which is not only the second 'Perfect Number'²³ but also the number which the Jabirian writer of the 'Books of the Balances' substituted for the earlier 60 of Apollonius as the secondary Basal Number: while the numbers in the residual square are 1, 3, 5 and 8, viz.: the actual all-pervasive group of numbers in the Jabirian 'Books of the Balances'.

In these treatises the following numbers were allotted to the four Elements:

1 FIRE	5 WATER ²⁴
3 EARTH	8 AIR

As all metals were believed by the alchemists of the Middle East from at least²⁵ 200 B.C. to be composed of the four elements, presumably, if the composition of the different metals can be represented by Magic Squares, their differences, e.g. in the internal and external distribution of the constituent elements, as well as the relative 'Powers' and proportions of these elements, must, in the same way, have been indicated either by the *gnomonic* total, or some other number characteristic of each individual Square. This point may possibly be dealt with in a subsequent paper: but it may be noted here, in connection with the *gnomonic* analysis of higher squares than 3² that a double- (or multiple-) lined *gnomon* may have to be used. We have already seen that

²³ As previously noted (n. 5), the title, 'CXII Books', given to the first—and oldest—collection of the Jabirian *Corpus*, probably has reference to this Perfect Number 28, as $112 = 28 \times 2^2$.

²⁴ The fact that 5—the number at the centre of the Magic Square—is that assigned to Water may have some relation to the Middle Eastern belief, both of Thales (640–550 B.C.) and of the Hermetic writers, that everything originates from Water. Furthermore, according to Plato's assignment in the *Timaeus* of regular solids to the Elements the number of scalene right-angled triangles required to make up the Tetrahedron (assigned to Fire) and those constituting the Icosahedron (assigned to Water) bear the proportion 1 : 5. This, however, may be only a chance coincidence, as the analogy cannot of course be applied to the Cube (assigned to Earth) as this is made up of a different form of triangle, viz.: isosceles right-angled: while the comparable proportionate number of scalene triangles for the Octahedron (assigned to Air) is only 2.

As for Plato's other theory—also found in his *Timaeus* (which dates from c. 360 B.C.)—that the metals are all 'fusible water', it may be noted that in the earliest known Chinese treatise on Alchemy (that of Wu Po-Yang, written c. A.D. 142), the number assigned to both Water and Metal (or Gold) is 15 (cf. Lu Ch'iang Wu's translation *Isis*, 1932, XVIII (2) p. 243). This number may be regarded as either three times the mystic Chinese number 5, or one-quarter of the Chinese sexagesimal unit 60, or as having reference to the two halves (waxing or waning) of the Lunar Month.

²⁵ Bolos, the Egyptian alchemist, who claims Democritus of Abdera (c. 420 B.C.) and the Persian Ostanès, as the sources of his knowledge (cf. Festugière, *op. cit.*, Chap. VII).

no particular result was obtained in the case of the 16-Square with a single lined *gnomon*. If, however, the *gnomon* is enlarged to 12 units, both the *gnomonic* total of 102 (i.e. $17 \times 3 \times 2$), and the total of numbers in the remaining square area, viz. : 34 (i.e. 17×2) posses, as their base, the number 17.

There is, however, no need to pursue the quest any further as, from the first two Squares, it seems clear that the problem of why the Jabirian writers adopted this particular number has now been solved. In the Magic Square allotted to Lead, the supposed inner secret of Matter was vouchsafed to the alchemical world, just as clearly (or obscurely) as Albrecht Dürer may have intended to indicate to Europe the date of composition of 'Melancholia' by means of the 15-14 given in the last line of the 16-Magic Square that is included by Dürer in his famous engraving.

The Use of the Magic Square in Chinese Worship.

Having now demonstrated that the curious Numbers on which Jabirian alchemy was largely based were enshrined for the benefit of initiates in the 9-Magic Square, let us now pass on to consideration of the question "From what ultimate source were Magic Squares derived?". As will be seen from what follows, this may at least be partially answered if we consult ancient Chinese records, for in these we discover that the ground plan of the *Ming-Tang*—the Imperial 'Hall of Distinction' (or 'Mystic Enlightenment')—is that of the same Square of Nine.

Chinese chronology is notoriously doubtful: but, apart from the fact that a *Ming-Tang* was built in A.D. 56 during the Hān dynasty, a much greater antiquity for this form of temple is indicated, firstly, by a temple of this plan being essential for Imperial worship, and, secondly, that in the 7th century B.C., during the time of the warring Lords, it was believed to have been used by Wu, the alleged founder of the Chou dynasty in 1025 B.C., when sacrificing to his ancestors²⁶. Moreover, if this tradition be correct, the Magic Square form of temple may ultimately be of Scythian origin, introduced at this time from Bactria, or ancient Irān, with the foreign mercenaries from the West, to whose help Wu owed his success in establishing a new dynasty⁷.

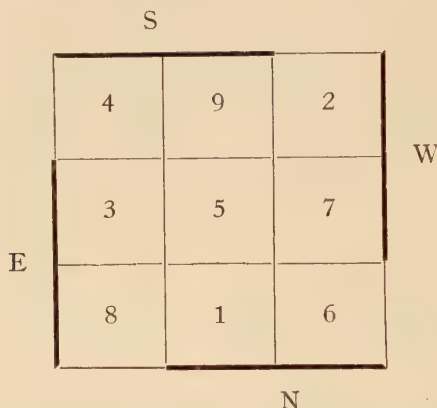
The structure and orientation of the *Ming-Tang* will be understood from the following reproduction of the plan given by Granet on p. 117 of the same work.

The *Ming-Tang* seems to have been chiefly used for the promulgation of the monthly ordinances, and especially for the proclamation of the Calendar regulations, necessitated by the Chinese year having a variable length. Apart

²⁶ Granet, *Danses et Légendes de la Chine ancienne*, pp. 72, 117, n., 121, 140, n. 5. The date mentioned is now considered by Sinologists to be more correct than Granet's 1122 B.C.

²⁷ Coyajee, *J.A.S.B.*, 1928, XXIV, p. 201 (quoting from D. A. Mackenzie's *Myths of China and Japan*, p. 290: and Hirth's *Ancient History of China*, pp. 65-70).

from the central room, each of the four rooms bearing an odd number had a single canopied Dais, whereas each of the even-numbered corner rooms had two such raised platforms. This gave a total of 12 such sites for the necessary monthly 'Proclamation of Space and Time'.



The square plan of the temple is in accordance with the Chinese idea of the form of the Earth: and 5, the emblem of the Centre, is the number regarded with even greater respect in China than it was by the Pythagoreans, e.g. the 5 Elements of the Chinese (Wood, Fire, Earth, Metal and Water): the 5 Stones from which Niu Koua, the first coppersmith at the time of the Flood, taught men to prepare Copper²⁸; the 5 square Zones of Space (surrounding the square Earth), etc. etc. Round the central 5 (which, in all probability, referred to the 5 Elements) are found, alternately Even and Odd numbers, while if the pairs are considered as grouped in Swastika form round the centre, the four couples 1 & 6, 2 & 7, 3 & 8, and 4 & 9, indicated (as shown in the diagram) the chief compass directions, viz. North, West, East and South.

The Possible Inter-relation of Chinese and Islamic Thought.

Attention to the early association in China of the Magic Square with religious ritual was first drawn by the writer's former colleague, the late Sir J. C. Coyajee, in one of a series of papers on Zoroastrian doctrines that

²⁸ The Chinese date for the discovery of Copper is c. 2200 B.C., i.e. about the time of the supposed founding of the 1st Dynasty by Emperor Yü. As in the opinion of Albright (*Archaeology of Palestine*, 1949, p. 65), Metal working in the Near East began c. 4500 B.C. and Copper (or Bronze) was certainly in common use in Mesopotamia, c. 3000 B.C., Niu Koua may have been either a foreigner or, more probably, a Chinese who had travelled westward, and, on his return home, introduced the art of Copper Smelting into China. Previously, implements and weapons had been made of Stone, or Jade.

It is of some interest to note that one of the stones said by Taoist writers to have been used by Niu Koua was *Tansha* ("Red Sand": Mercuric Sulphide). This substance was regarded by these later alchemists (e.g. Ko-Hung of A.D. 330) as one of the essential constituents in the preparation of the Elixir for making Gold or Silver. This Elixir, if taken for 100 days, also made the taker immortal.

appeared between 1928 and 1932 in the Journal of the Asiatic Society of Bengal. Prof. Coyajee in his 1932 paper on the *Sraosha Yasht* dealt, in particular, with the possible derivation of Muslim Sufism from Zoroastrianism ; but, in doing so, he found it was again necessary to consider the influence on the *Avesta* of Taoism, the second of the three ancient religions of China.

Taoism is founded on the belief that the primal Creative Cause is the revolution of the Heavens round the Earth. As the Pole Star to the Chinese is the visible end of the axis of this movement, the Creative Energy (*Tao*, or Path) of the Universe was supposed to be centred at this spot. The Taoist creed may be understood from the following quotation from the 4th century B.C. writer, Chuang Tsü :—

What there was before the Universe was *Tao* : *Tao* makes things what they are, but is not itself a thing. Nothing can produce *Tao* : yet everything has *Tao* within it, and continues to produce it without end ²⁹.

From this, it will be seen that the Chinese *Tao* corresponded very closely to 'The One' of Western Alchemy. This is worth emphasising, in view of the particular interest taken in alchemy by re-actionary successors of Chuang Tsü, who wished to revert to belief in a Magical Spirit-dominated world—that primitive form of religion from which Confucius and Lao Tsü had endeavoured to free 6th century B.C. China. The earlier Taoist mystics practised the control of breathing and abstention from food as a means of attaining *gnosis*. They also certainly emphasised the desirability of a long life on earth, during which they could learn to prepare themselves fully for the Taoist Paradise : but later—from at least the beginning of the Hān Dynasty, i.e. 206 B.C.—this idea developed into a systematic attempt to prepare an Elixir of Life from mineral substances.

Apart from proving—as he considered ³⁰—in his 1932 paper, that Zoroastrianism incorporated many Chinese ideas, e.g. the *Yin* and *Yang*—Earth the receptive feminine principle, and Heaven, the male fertiliser—Prof. Coyajee pointed out (p. 228) that the numerology of the Šūfi hierarchy in Islām was apparently derived from that of the 9-Magic Square that formed the ground plan of the Imperial Chinese Temple.

In Al-Hujwīrī's *Kashfu-l-Mahjūb* ³¹, we find the following passage :—

Of those [Saints] who have power to loose and to bind and are the officers of the Divine court, there are Three Hundred, called *Akhyār*, and Forty, called *Abdāl*, and Seven, called *Abrār*, and Four called *Awṭād*, and Three, called *Nuqabā*, and one, called *Quṭb*, or *Ghawṭh*.

²⁹ Soothill, *The Three Religions of China*, p. 53.

³⁰ In view of the present agreement among Sinologists that the *Yin* and *Yang* theory did not come into prominence in China until about 300 years after the time of Zoroaster, it would now seem more probable that this Chinese theory was derived from Zoroastrianism.

³¹ R. A. Nicholson's 1911 translation, p. 214. Al-Hujwīrī wrote his 'Revelation of the Mystery'—the earliest Persian treatise on Sufism—about A.D. 1070 : but the hierarchy he describes may have been originally formulated by the 6th Imām, Ja'far aṣ-Ṣādiq, whom many Muslim Shi'ites believe 'was commissioned to give the Mohammedan system its most definite and permanent form' (J. Wortabet's—1860—*Religion in the East*, p. 275).

Now if we multiply together the three numbers attached to the rooms on each side of the *Ming-Tang* and add the four products, thus $(8 \times 3 \times 4) + (4 \times 9 \times 2) + (2 \times 7 \times 6) + (6 \times 1 \times 8)$, we obtain the number of *Akhyār*, viz. :—300. The sum of the circumferential numbers of the rooms round the central 5-room is 40, viz. the number of the *Abdāl*. The 7 *Abrār* and 3 *Nuqabā* represent East and West in relation to the Unity of the Polar Star, and the hierarchal inferiority of the *Abrār* and *Nuqabā* to the *Qutb* is indicated by their slightly withdrawn position in the plan. Finally, the 4 *Awṭād* correspond to the 4 Chinese Polar Mounts; but in Šūfism, as the Arabic word indicates, they have become the 4 Tent-Pegs of the doctrinal Tent, the roof of which is supported by the central Pole, or *Qutb*.

If Coyajee's conclusion that the Šūfi hierarchy was based on the numerology of the 9-Magic Square is correct, this must inevitably be regarded as of great importance in the history of Alchemy, seeing that :—

- (a) Jābir is almost invariably described as a Šūfi in the earlier portions of the *Jabirian Corpus*;
- (b) (as demonstrated earlier in this paper) the 9-Magic Square is the real source of the numbers 28 and 17 (the total of the series 1 : 3 : 5 : 8) on which Jābir's 'Theory of the Balance' is based; and
- (c) the Imām Ja'far aš-Šādiq, who is stated in the *Corpus* to have been the chief person to encourage Jābir to interest himself in Alchemy, is included by Al-Hujwīrī as one of the earliest members of the Šūfi community.

*Further Discussion of the significance of the 9-Magic Square in China :
and its possible sources of origin.*

On the Magic Carpet of these Squares, the reader has found himself carried from Byzantium to Germany: from Germany to the Middle East—particularly to Ḥarrān: and from Ḥarrān to ancient China. Let us now see what deductions can be made from the facts that have presented themselves and what further enquiries are necessary before any certainty as to where Alchemy actually originated can be reached.

As we have already seen, this Magic Square constitutes the ground plan of the Chinese Imperial Temple, which may possibly be traced back to the 11th century B.C. This does not necessarily mean that it actually originated in China, as the founder of the Chou dynasty owed his success to Western mercenaries, who, as Coyajee pointed out in his J.A.S.B. 1928 paper (p. 201) may have brought with them new cultural and philosophic ideas from the country round the ancient city of Balkh³²: and this area in turn—as will be noted later—can hardly have escaped being influenced by the far more ancient civilisations of Mesopotamia.

³² For the discussion of the importance of Balkh as a cultural and ethnic centre, see *Mem. A.S.B.*, 1927, VIII, pp. 402–3, n.

Apart from this possibility that external philosophic and ritualistic ideas may have entered China from the West in the last quarter of the 11th century B.C., what can be gathered regarding the actual significance in ancient China of this Magic Square ?

The chief points to be noted are :—

- (a) that the *Ming-Tang* is a Temple of ' Enlightenment ' or ' Divination ', i.e. a building in which the Son of Heaven was supposed, with the aid of suitable prayers or incantations, and the use of incense, to become the incarnation on Earth of the Deity ; and
- (b) that the numerical plan on which the temple was constructed bore some relation to the Five Chinese Elements—Water, Fire, Wood, Metal (or Gold) and Earth—out of which, Matter, and the world in general that can be perceived by the intellect, has been formed ³³.

As for (a), the reason for the subsequent adoption of the *Ming-Tang* ground plan as an alchemic Talisman is simply that the Taoist alchemist considered that, by its use, he himself became able to take the place of the Creator in the production of either an Elixir for transmuting base metals into Gold, or of some preparation of Gold that would function as an Elixir of Life ³⁴.

In the case of the *Ming-Tang*, the numbers attached to the rooms may only be due to the accident of some early mathematician having stumbled upon the fact that the pairs of the simpler numbers can be arranged in such a way round a central 5, that the sum of each pair of opposite numbers is 10, viz. : twice the Central Number.

Five being the number of fingers on one hand, both this number and the

³³ In Prof. Dubs' ' Beginnings of Alchemy ' (*Isis*, 1947, 28, p. 73) it is pointed out that in Chinese Alchemy—possibly from 300 B.C.—the following equations existed between the 5 Chinese Elements, the 5 Colours, and the 5 Directions (including the Centre) : Earth = Yellow = Gold = Centre : Wood = Azure = Lead = East : Fire = Red = Copper = South : Metal = White = Silver = West : Water = Black = Iron = North. The *Ming-Tang* is not referred to in Prof. Dubs' paper : but these equations may be considered in connection with the *Ming-Tang* ground-plan on p. 16 *supra*.

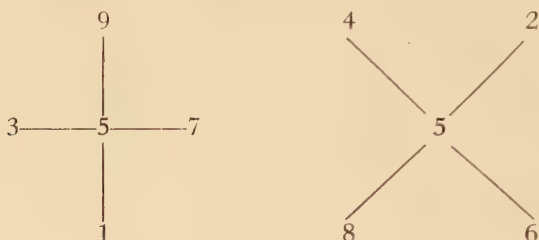
³⁴ The belief in the life giving properties of Gold was probably world-wide in ancient times : in Egypt it goes back to at least 3000 B.C. There, the metal was both associated with the Great Mother, the Divine Hathor ; and regarded as the seed of the Sun God, Ra, from which all the Pharaohs were conceived. It was also the essential metal for making the death mask of the Pharaohs to maintain life in their mummies after earthly death (*cf.* G. Elliot Smith's *Human History*, Chap. IX). Even in England as late as 1685, a preparation of gold was administered to Charles II on his death bed in the attempt to save his life, when other medicines had failed.

In the announcement by Reuter's Berlin correspondent in December 1949 that, according to rumour in the Soviet zone, Marshal Stalin was being given an Elixir of Life, the ingredients were not stated : but this modern belief in a medicine for prolonging life shows that the quest for such an Elixir still persists

hand itself have always had a magical significance³⁵, and this may be the basic reason for the Chinese belief in the existence of five elements. The number attached to the central chamber of the *Ming-Tang* either symbolises the Earth (as Granet thought: *op. cit.*, p. 256) or, more probably, the Five Elements: seeing that all the mystic diagrams (the *Kuas*), discussed in the Confucian 'Book of Changes', are stated by the disciple of Confucius who edited the book after the Master's death to express the phenomena of Nature³⁶.

Mention of five Elements may be traceable in China as far back as the 12th century B.C.: but it is difficult to follow Granet in his explanation of the *Ming-Tang* plan, viz.: linking up the numbers with the *Yin Yang* theory of 'Opposite Principles', as the latter did not come into prominence in Chinese philosophy till many centuries after the earliest appearance of the *Ming-Tang*³⁷. However tempting it may be to draw a parallel between the *Yin Yang* theory and the Pythagorean theory of Opposites, it would appear safer to limit enquiry into the structure of the *Ming-Tang* to a consideration of the arrangement, round the centre, of the remaining Odd and Even numbers.

If we represent these numbers by separate diagrams, we obtain



The total of the circumferential numbers is in each case 20, viz. 5×4 (the number that implies in China completion of Space); while the sum of all the numbers in both cases is 25 (i.e. the square of 5), which still further emphasises the magical importance ascribed to the number 5. Moreover, in both cases, the radial numbers are associated with compass directions, to which, again,

³⁵ Cf. the *Kaff an-Nabī* (Handprint of the Prophet) which the writer has often seen painted on the prows of Muslim-owned boats in Eastern Bengal. In 1912, round Jerablū on the Euphrates, Sir Leonard Woolley found the *Kaff an-Nabī* was placed on houses to show that one in the house had made the pilgrimage to Mecca.

³⁶ Soothill's *Three Religions of China*, p. 150.

³⁷ Cf. Liang on the Antiquity of the *Yin Yang* theory and of the Five Chinese Elements: quoted by T. L. Davis, *Isis*, 1932, XVIII, pp. 216–221. The first mention of the Five Elements in China occurs in the *Shu Ching* (Book of Historical Documents) that is supposed to date from the 12th century B.C. On the other hand, *Yin* and *Yang* (the Feminine or Negative, and Male or Positive principles in Nature) can only be dated back with certainty to the Taoist Tsou Yen of the 4th or 3rd century B.C., so that China may—like Pythagoras (see J. E. Raven's *Pythagoreans and Eleatics*, p. 18)—have derived the idea of the importance of contraries from the religious teaching of Zoroaster of Balkh (in the 6th century B.C.) that the world was ruled by two deities, Hormuzd, the Good, and Ahriman, the Evil One.

great ritual importance seems to have been attached in ancient China in connection with the supposed radiation of healing and creative Virtue into and from the realms of Time and Space at the accession of each Emperor. The time at which this radiation occurred was the moment when the Emperor offered the necessary ritual prayers : while the Space Centre was the *Ming-Tang* temple at which the ceremony took place.

It is true that Kraus gathered (II, 137, n. 1) many examples of the importance attached to the number 5 in both ancient Greek and Arabic writings (e.g. the Jabirian principles that govern Generation : Substance, Quality, Quantity, Space and Time) : but, as has already been shown, there is good reason to believe that the Magic Square was known in China long before it was formally discussed in the 6th century B.C. Confucian *Book of Changes*, while the earliest date at which it may have been known in Europe is the 3rd century A.D. The attribution to the Chinese must, therefore, be accepted—at least until the use of such a Square by either the Babylonians, or the inhabitants of some other country of the Middle East, happens to be proved by archaeological excavations for any date earlier than 1000 B.C.

*Chinese theories on the Constitution of Matter :
and the association of their ' Elements ' with Planets.*

To facilitate comparison of Chinese ideas (on the relation of the Elements to the Planets) with those of the Harrânians on the intimate connection of the Planets with the Metals that will be found epitomised in a subsequent Table, we may conclude our discussion of China with a few remarks regarding the 5 Chinese Elements, and the list of 5 Planets, recognised by the Chinese.

The Sun and Moon were not included among the Planets, as—instead of (like their 5 Planets) merely influencing mundane affairs, and matter generally—the Sun and Moon seem to have been assigned from the earliest times a Creative function, as the Elements were believed to have been formed out of *Tai Chi*—the Great Monad, or Primal matter—by the interaction of Sun and Moon.

Air was probably excluded from the list of Elements, owing to it being regarded as a Spirit that had—under the guise of a Wind or Storm—to be placated by the aborigines who roamed about Northern China in the windswept dusty plains that lay to the south of the receding Ice belt. The addition of Metal to the original 4 Elements, Water, Fire, Wood and Earth, may reasonably be assigned to the period about 2000 B.C., when Smelting first became known to the Chinese.

Niu Koua, the first smelter, is said by the early 4th century Chinese alchemist Ko-Hung in his treatise *Pao p'o tsu*³⁸ to have made copper out of the 5 Coloured Stones, among which copper sulphate, mercury sulphide and orpiment are certainly found. The Chinese 2000 years ago also recognised the 5 Metals—Gold, Silver, Copper, Iron and Lead. The last named may have been confused with Tin (as happened later in Arab times) : but in addition to these metals the

³⁸ Granet, *op. cit.*, p. 497.

magic-working *Khārṣīnī* ³⁹ out of which the crooked arrows—used against the demons that caused eclipses—were made, must also have been recognised.

The following Table summarises the earliest available information regarding the Chinese Elements and their connection with the 5 Planets recognised by the Chinese ⁴⁰.

Order of the Elements in the 12th century B.C.	Accompanying Statement regarding each Element	Associated Planet
I. Water II. Fire III. Wood IV. Metal V. Earth	Soaks : and Descends Blazes : and Ascends Straight and Crooked Obeys : and changes Of use for seed-sowing and harvest	Mercury Mars Jupiter Venus Saturn ⁴¹

The other 'cyclic' list that was current in later times seems to have been drawn up under Taoist influence to show how each Element changes into the next ⁴². In this list, Wood is placed between Water and Fire, and Earth and Metal change places. Water becomes Wood when a tree grows with the help of Rain : Wood produces Fire when burnt, as well as Earth in the form of Ash : Fire produces Earth when solutions are evaporated : Earth produces Metals : and Metals, when fused, become Water.

*Harrānian Beliefs on Cosmology :
and the Temple Worship based on these Beliefs.*

These were discussed previously by the writer (pp. 398–404 of the 1927 *A.S.B. Memoir* already referred to) and only a brief summary need be given to indicate the importance of Harrān in the dissemination of ancient learning, before passing to a detailed consideration of the Alchemy that seems to have been practised there.

³⁹ Cf. *Mem. A.S.B.*, VIII, pp. 340–2 and 405–11.

⁴⁰ *Isis*, XVIII (2), *op. cit.*, pp. 217 and 220.

⁴¹ Dr. G. L. Lewis notes—as a rather odd coincidence—that Saturn also appears in the Mediterranean as the ancient Italian agricultural deity, presiding especially over sowing.

⁴² The same conception of transmutation among the Elements is found in a quotation by Marcus Aurelius from Heraclitus of Ephesus (c. 500 B.C.) :

The Death of Earth is to become Water (Liquefaction) ;

The Death of Water is to become Air (Evaporation) ;

and The Death of Air is to become Fire (Combustion).

Did this idea of Element flux occur independently to thinkers in the East and West, or did it originate in some intermediate centre ? It is, of course, implicit in another dictum of the Taoist Chuang Tsü quoted by Soothill (*op. cit.*, p. 56) “ The reality of the formless : the unreality of that which has form ”.

Ḥarrān⁴³ was a Syrian town lying in the great western bend of the Upper Euphrates, and continued till the 10th century A.D. to be the last outpost of Sumerian, Hittite, and Babylonian civilisations. With the fall of Babylon in 528 B.C., it became a unit in the vast empire of the Medes and Persians: and, if Massignon's opinion (Appendix III to Festugière's *Hermes*, p. 389) is correct, it was during the Achaemenid period that fusion occurred of Persian, Syrian, and Greek theories of Nature, with the result—as he remarks—that the Ḥarrānian Hermes became the polyglot Deity of Commentators and translators. Egypt was conquered by Cambyses, the 2nd Achaemenid ruler, in 525 B.C.: and it was during the two centuries of Persian rule that followed, until the overthrow of the Iranian Empire by Alexander, that the infiltration into Egypt of this fresh synthesis of thought probably occurred—attributed later to the Persian Ostanēs, and even to Zoroaster himself⁴⁴.

The establishment of a Greek Empire in Egypt by one of Alexander's Generals, Ptolemy Soter (323–285 B.C.), and of the great Library in the Museum of Alexandria, resulted in the thorough Hellenisation of Egypt under the influence of Greek philosophic thought that had grown to maturity since 600 B.C. When the line of the Ptolemies ended in 30 B.C. with Cleopatra, Egypt passed into the hands of the Romans: during whose time Zosimos, the alchemist of Panopolis, lived and wrote in Greek at Alexandria (c. A.D. 300) the treatises to Theosebeia, in which he incorporated much earlier material, e.g. from Egyptian, Iranian, Chaldean, and Greek writings, as well as from practical works like those of the Jewish woman alchemist, Mary⁴⁵. Finally, the rule of the Eastern Roman Empire over Egypt came to an end by its conquest in A.D. 641 by the Muslims under 'Amr ibn al-Āṣ.

We owe to Chwolsohn's *Die Ssabier und der Ssabismus* most of our knowledge of Ḥarrānian beliefs; and, from the following Table, it will be seen how closely their Temple worship was associated in the first place with the 7 Planets (including the Sun and Moon) and, on the other, with Metals, Colours and Numbers.

This Table presents an utterly different, and much more advanced stage of, civilisation than that of the Chinese we have previously been considering. To begin with, it demonstrates the existence of a community possessing an almost modern knowledge of Metallurgy—seemingly far in advance of that of

⁴³ Now represented by a vast area of mounds, exceeding in extent even those of Ur of the Chaldees.

⁴⁴ As early as 200 B.C., the peripatetic philosopher Hermippos noted in his treatise on Magicians that the Library of Alexandria possessed numerous works ascribed to Zoroaster—totalling probably at least 800 MS. rolls (Festugière, *op. cit.*, p. 43).

⁴⁵ The part played by Jews (and Jerusalem) in the exchange of ideas current in various places of the Near East may be gathered from the list of Jews recorded in *Acts* 2, vv. 8–11 as present in the Jewish capital in A.D. 33. Their homes ranged from Media in the N.E.: Pontus (on the Black Sea) to the N.W.: Rome, Crete and Cyrene to the W.: and Egypt and Arabia to the S.W. and S.E.

Planet to which the Temple was dedicated	Metal of which the God's image was made	Associated Colour	Geometrical Structure of Temple	Number of Steps to the throne of each Idol ⁴⁶
1. SATURN	LEAD	Black	Hexagonal	9
2. JUPITER	TIN	Green	Triangular base: roof and angles pointed	8
3. MARS	IRON	Red	Oblong	7
4. SUN	GOLD (Image hung with PEARLS)	Yellow	Square	6
5. VENUS	COPPER	Blue	Triangular (with one side longer than the other two)	5
6. MERCURY	An alloy of <i>all</i> the metals, including <i>Khār-sīnī</i> (Chinese Iron). The hollow interior was filled with MERCURY—thus imparting to the Image the 'Spirit' of the Planetary deity	Brown (At the Wednesday service a Brown youth who was a good scribe was slain, quartered, the quarters separately burnt, and the ashes thrown in the face of the image)	Hexagonal, with a Square interior	4 (circular)
7. MOON	SILVER	White	Pentagonal	3

⁴⁶ Though no reference seems up to now to have been recorded in cuneiform inscriptions to the association of Magic Squares with Mesopotamian religion, it may be pointed out that the figures in this column represent *in inverse order* the number of cells on the sides of the Magic Squares assigned in Agrippa's 1533 Treatise to the Harrānian Seven Planets and Metals.

In connection generally with this Table two further points should be noted. Firstly the number of steps in the different Temples are only given by Al-Dimashqī (c. A.D. 1300),

Pharaonic Egypt. If we look further into the other details given by the Arabic writers quoted by Chwolsohn, we also find Ḥarrān intimately linked up with India (Sind); the ancient Syrian towns of Damascus, Tyre and Hierapolis; Egypt (Heliopolis); Balkh (where the Fire Temple of the Barmacides is said to have been preceded by a temple of the Moon—the Babylonian God Sin, and, still earlier, the Sumerian Nannar of Ur); while, finally, the mention of *Khārṣīnī* in connection with the temple dedicated to Mercury, points to some degree of trade with distant China. Inevitably, therefore, Ḥarrān must be regarded as a great centre of communication and trade in the ancient East, and specialising, above all, in the metals produced from the mines of Asia Minor, Kurdistan and Persia. It may be visualised, with comparative certainty, as one of the chief markets from which successive Mesopotamian dynasties satisfied their needs for gold, silver, copper and tin, as well as mineral substances, such as the arsenic sulphides, borax and sulphur. Iron too must have been bought and sold by the Ḥarrānians after 1200 B.C. when the Hittite monopoly in this metal came to an end: while—at some early date ⁴⁷—lead was also added to the list.

A Text of Ḥarrānian Alchemy—the Treatise of Agathodaimon.

Except for an observation by Sir Leonard Woolley in 1912 that the 9-Magic Square was still employed in the vicinity of Ḥarrān ⁴⁸, for the magical care of toothache, by a local *mullah*, no evidence has been found up to now of the possible utilisation of any such Square in Ḥarrānian religion: but, as regards the practice of Alchemy, an Ḥarrānian text has fortunately survived in Arabic translation, viz. the *Risālatu-l-Ḥaḍar* (Treatise of Warning) ascribed to the 'Ṣābian' Prophet and Teacher, Agathodaimon. The 13th

and not by Al-Masʿūdī (c. A.D. 920): so that they may have been introduced into the account of Ḥarrānian temple structure, owing to the discussion of Magic Squares in the *Rasāʿil* of the *Ikhwānu-ṣ-Ṣafā* (c. A.D. 970). The late Dr. Ruska (in his article on 'Wafq' in the *Encyclopaedia of Islam*) also remarked that some unspecified Arabic bibliographers are of opinion that this part of the *Rasāʿil* was derived from a treatise of the Ḥarrānian mathematician Thābit b. Qurra, who died in A.D. 901.

Secondly, it has recently been shown by Mme. H. Lewy (*Hrozný Festschrift*, Part IV, Prague, 1950) that in Palestine c. 1000 B.C. the so-called 'Solomon's Seal' was the symbol of the Planetary God Saturn. The assignment by all the Arabic writers on Ḥarrānian religion of an Hexagonal ground-plan to the Temple of Saturn is what might be expected, as not only is the centre of Solomon's Seal a Hexagon, but another external Hexagon—twisted at 45° to the first—results from the joining by straight lines of the six projecting points of the figure.

On the other hand, as the Patron God of Ḥarrān was Sin, the Moon God, we may expect that the even older Pentagram (*vide* Appendix A, *infra*) will also be found during the exploration of the ruined mounds of Ḥarrān that is now being undertaken by the British Institute of Archaeology at Ankara.

⁴⁷ Certainly before 1500 B.C., as Lead sheets were used to line the treasure chests in the Cretan Palace of Minos—built about that time.

⁴⁸ At Jerablūs, the former Hittite fortress of Carchemish, on the Euphrates.

century writer Al-Dimashqī states that the Ṣābians believed that Agathodaimon derived his doctrines from Enoch (the son of the Biblical Cain) who, in turn, was Hermes Trismegistos, whom the Muslims identified with the Qur'ānic Idris: but, as will be seen later, it is difficult to assign more than a rough—though, still, very early—date to the treatise we are considering.

A summarised translation of this treatise—taken from a MS. in the Royal Cairo Library, and keeping as closely as possible to the phraseology of the Arabic—will be found in Appendix B: and from the contents, as well as the attached notes, it will be clearly evident that in it historians of science possess one of the texts on which many of the subsequent Alexandrian alchemical writings were based. Quite apart from the comparatively simple style of the treatise—so different from that of the ordinary run of Greek alchemical texts—there can be little doubt of its authenticity, seeing that:—

- (1) It was known to Zosimos of Panopolis (c. A.D. 300), as shown by the reference to passages contained in it not only in the fragments of Zosimos' writings that have survived in Greek, but also those in Arabic translation: and
- (2) It was the text from which much of Jāmāsp's treatise on Alchemy for Ardashīr, the first Sasanian King (A.D. 226–241) was drawn.

Another Arabic translation in the Cairo Library, bearing the title 'The Book of Asfidūs on the Wisdom of Aflārūs', and couched in almost the same phraseology as that used by Jāmāsp, turned out, on inspection, to be mostly a paraphrase of No. 2. In spite of the similarity of the texts, these two works in Arabic times were regarded as separate treatises, and are both quoted by Ar-Rāzī in his *Shawāhid*.

In the Agathodaimon treatise, the Greek names of the reputed author as well as of his teacher Hermes⁴⁹ indicate that the original Mesopotamian theory of the divine Art of Alchemy underwent a certain degree of Hellenisation—presumably during the period when Syria and Mesopotamia were included in the Greek empire of the Seleucids (312–65 B.C.). As it stands, the treatise claims to be based on the sayings of Hermes 'in his Books', particularly on the saying "The Stone is a Stone and not a Stone". The 'Noble Stone', or Elixir, was derived from the 'One Thing' (i.e. 'The All', which is both God, and everything God has created), and was apparently regarded by the Ḥarrānians as the Essential Nature (*kiyān*)⁵⁰ of, at least, all mineral substances, and metals.

From the actual text of Agathodaimon, as well as what is found in the subsequent commentaries of Jāmāsp and Asfidūs, it is clear that the laboratory

⁴⁹ This may be a Hellenised form of the ancient Hittite Moon-God ARMA (cf. E. O. von Lippmann, *Ambix*, 1938, II, p. 21): or even of HORMAZD—the colloquial pronunciation of Ahura Mazda, the chief Zoroastrian deity.

⁵⁰ Cf. the aim of every artist to convey to others the *essential aspect* of whatever he is trying to depict.

procedure (*tajribah*, or 'experimenting') followed by Harrānian alchemists was based on an extremely simple theory, viz. that the minerals, created by 'The One' out of 'The One', were made up of two *opposites*—*Jasad* (Matter capable of being endowed with a Spirit) and *Ruh* (Spirit). This is important historically, as suggesting that the theory may go back to, at least, the time of Zoroaster, the Magian Prophet who—according to A. V. W. Jackson—died c. 583 B.C., aged 77. The merit of Zoroaster, as a religious teacher, lay in his attempt to replace the age-old polytheistic Nature worship by something that, while recognising the closely intertwined admixture of good and evil in mankind, at the same time pointed the way to the acceptance of a Single Deity. On the one hand, Zoroaster postulated a Creator God, Ahura Mazda, who cared for, and protected from evil, the human race he had created. On the other, we find Ahriman, the Devil, who led men astray—Ahura Mazda's twin, against whom continual battle on behalf of mankind had to be waged. Seeing, too, that Zoroastrians were Fire worshippers, one of the names by Agathodaimon to the Elixir, viz. 'The Light of the Earth', may be regarded as confirming the suggested association of the alchemical ideas contained in Agathodaimon's treatise with Zoroastrianism⁵¹.

Not only can these apparent links with Zoroastrianism be detected in all three treatises, but another fact also demands careful consideration. The metal to be used for the alchemical preparation of Gold and Silver is *Copper*: and there is no reference at all to the Metal Lead that appears at the head of the list in the Harrānian Planetary Table of the Metals. This is all the more curious, as when we study the writings of Zosimos, we find passages similar to the one previously quoted (note 18), from which it is clear that, in Alexandrian times, the basic metal employed in alchemical operations was Lead. It is true that Copper is still mentioned by Zosimos, but only⁵² either as a synonym for 'The Stone' (owing to the appearance of the red colour of Copper at some stage of the operation) or as part of the name *Molybdo-Chalkos* that appears in Arabic as *Abār-Nuḥās* (Lead-Copper). No clue as to why Lead had superseded Copper in alchemical operations has hitherto been found in the writings of Zosimos.

A quotation from Hermes in Ar-Rāzī's *Shawāhid* "The 'Great Tincture' is formed from our 'Burnt Copper' and our 'Strong Water'. From other than these nothing can proceed. Fuse them together [in Marriage] until all the

⁵¹ In view of the extensive re-editing in Parthian and Sasanian times of the *Avesta*—the Zoroastrian Scriptures—some doubt exists as to whether the actual teaching of Zoroaster was not tinged in the process by Alexandrian gnosticism. It may therefore be of interest to note that an exiled Hebrew poet—who could have met disciples of Zoroaster—apparently utilised some of the religious ideas that were then in the process of adoption by the new Persian overlords of Mesopotamia to put fresh heart into his own fellow exiles. The stanzas in question of Deutero-Isaiah (Isaiah, R. V., 45, vv. 5 & 7) are:

'I am the Lord, and there is none else: beside me there is no God.'

'I form the Light and create the Darkness: I make peace and create evil.'

⁵² The reference in note 81, *infra*, is probably a quotation from Agathodaimon.

Copper is melted and mixes with the Water to form the 'Great Stone' " confirms the impression that Copper must have been the first metal to be employed in alchemical operations: so we have next to consider what this implies.

In the absence of adequate data from early sites in Mesopotamia as to the order in which the different metals first appear, it is somewhat rash to hazard any conjecture: but one suggestion may at least be made with the purpose of provoking further enquiry. Does not the mention by Agathodaimon of *only* the metal Copper point to Alchemy having started when Copper was the chief metal in common use in Mesopotamia, i.e. in the Copper and Bronze Age, and at any date after 4500 B.C. when—according to Albright (*op. cit.*, p. 65)—the smelting of Copper from its ores may have begun? This period of human history came to an end about 1200 B.C. when the break up of the Hittite Empire into separate States like Carchemish ended its jealously guarded monopoly over the production of Iron, and brought in the Iron Age. It was only after this date that Metallurgical knowledge—to the extent shown in the Harrānian Table—could have become generally available to the craftsmen of Mesopotamia: and as no particular reason is apparent why Copper should have been then chosen for testing the possibility of making gold artificially, rather than the easily fusible Lead, there would seem to be no alternative but to accept the conclusion that Alchemy must have already been practised in the Copper Age before 1200 B.C.,—possibly even before Lead was known. It is therefore this earlier period that is mirrored in the Treatise of Agathodaimon: whereas the mention of iron rust—casual though this is⁵³—in the other two treatises, proves conclusively that they were written at a much later date, when iron had passed into common use, and its tendency to rust was well known.

Jāmāsp and Asfīdūs.

In the treatise of Jāmāsp (as well as in the similar text of Asfīdūs) the framework and basic ideas, e.g. the emphasis on the use of mineral substances only, and the theory of 'Body' and 'Spirit', are the same as those of Agathodaimon, but the authors evidently drew on additional sources of information. In the first place they did not rely on a single saying of Hermes but quoted and explained several others ascribed to Hermes. These were:— (1) "Cultivate Gold in the White Silvery Soil and drench it with the Water of Life"⁵⁴; (2) "Whatever you sow, that will you reap"⁵⁵; (3) "Make the 'Bodies' bodiless, and those that are bodiless 'Bodies' "⁵⁶; and finally

⁵³ The relevant sentence runs: "The substance will be formed in the First Operation, just as Iron Rust is formed."

⁵⁴ Cf. *Ambix*, 1949, *op. cit.*, pp. 72 and 76. Jāmāsp states that the 'Water of Life' is the 'Spirit' whereby not only the 'Body' exists but *continues to live after death*.

⁵⁵ Quoted by Ar-Rāzī in the *Shawāhid* as a saying of Hermes in connection with the need for using Gold and Silver as 'starters' or 'ferments' when making the elixirs for these metals.

⁵⁶ Cf. Festugière, *op. cit.*, p. 242.

(4) there is a single reference to the process of Giving in Marriage (*tazwīj*)⁵⁷.

Still more interesting from the historical point of view is the appearance in these two treatises of a fresh authority, viz. Democritus. The quotation that results from a collation of their corresponding passages runs as follows :—
“ My Master Ostanēs used to submit the ‘ Nature ’ to coction from without : then to triturate it : and (finally) to make the ‘ Poison ’ penetrate into its interior.” This establishes several links of considerable importance :—

- (1) Of both treatises with the comparatively primitive text of Agathodaimon (to whom Hermes is the only authority) through his mention of the ‘ Fiery Poison ’—extracted from the ‘ Natures ’ by Fire—by which the Essential Nature (*kiyān*) is then obtained from the Natures by breaking them up.
- (2) Of both treatises with Zosimos (c. A.D. 300) who regarded Democritus as having equal authority on the theoretical side, with Mary, the Jewess, from the practical side. In another quotation, occurring later in the same Cairo MS., we find Democritus stating *to an assembly in the time of Ostanēs* that the Tincture is from ‘ One Thing ’, and from that ‘ One Thing ’ ‘ Everything ’ is made. His hearers were therefore advised not to seek many Elements, but only ‘ The One ’ : and Zosimos goes on to support the opinion of Democritus by parallel quotations from Hermes, Osiris, and Agathodaimon.
- (3) Between Agathodaimon and Jāmāsp (c. A.D. 235, if the dedication to Ardashīr is authentic). Jāmāsp explains the action of the Poison, first, in relation to the Hermetic saying about making ‘ Bodies bodiless ’ and then to the Democritean⁵⁸ saying “ Nature rejoices in Nature, Nature cleaves to Nature, and Nature overcomes Nature ”. This, he says, has been repeatedly quoted by the Sages, and on this it is desirable for all men of wisdom to ponder deeply, seeing that ‘ The One ’ is a compound of the 4 Natures : Fire, Water, Air and Earth : and
- (4) Between Agathodaimon and Asfīdūs, who says practically the same thing as Jāmāsp, and regarding whom something more will be said later.

⁵⁷ According to the Hermes quotation in *Ambix* (*op. cit.*, p. 76) the marriage of the components of the Elixir, and conception of the Elixir by ‘ putrefaction ’, took place in the lower part of the alembic, while the Child—the resulting ‘ Spirit ’—was born in the top of the vessel.

⁵⁸ The story (translated by Festugière—*op. cit.*, p. 228–9—from Berthelot’s Greek text) of this being really that of Ostanēs, and its discovery by Democritus in a pillar of a temple to which he had been guided by Ostanēs’ son, was apparently not known to Zosimos : so the Greek MS. in question must have been written *after* A.D. 300.

Alchemical Practice in Harrān.

Philosophic and Scientific theories come and go—their only criteria of merit being whether they either help philosophical thinkers to solve (at least to their own satisfaction) the mystery of the Universe, or, in the case of science, encourage experiments to discover how far the theories lead to any reasonable result—expected, or otherwise. Interesting though the theories of the Harrānians, or of their predecessors, may ultimately be to students of Mesopotamian beliefs, they are hardly likely to appeal to the modern physico-chemist—temporarily bemused by philosophic and mathematical ‘Principles of Uncertainty’. On the other hand, for the historian of science, it is a matter of vital interest to collect any traces of technical practice, or the names of any chemical substances, employed by the inhabitants of an area where man first became acquainted with the processes used, and substances employed, in metallurgy: and we will therefore briefly summarise the scanty references that can be gathered from the purposely enigmatic phraseology employed by Agathodaimon, and his two successors, Jāmāsp and Asfidūs.

The following Table gives the very few Substances, and still fewer articles of Apparatus, that are mentioned in the Treatise of Agathodaimon.

Substances	Apparatus
1. Copper (and possibly Copper Oxide—‘Copper burnt by the Sulphurous element within itself’)	1. <i>Inā</i> (Vessel of undefined shape in which Coction took place)
2. Silver (<i>warag</i> : so possibly used in thin plates, or leaves)	2. <i>Ina’ al-Murtafa’</i> (either ‘The Exalted Vessel’: or ‘Vessel in which things are caused to rise’: if the latter, ‘Ascensory’ or ‘Still’)
3. Gold	3. Pot (<i>qidr</i>). For drying, on hot ashes, the moistened product of the Operation
4. Mercury	Finally, by implication:—
5. <i>Maghnīsiyā</i> ⁵⁹	4. A Furnace, apparently heated by burning Horse-dung
6. Rust	5 and 6. Rubbing Stone and Roller, for trituration (<i>cf.</i> Ar-Rāzī’s <i>Ṣalāyah</i> , and <i>Fih</i> r)
7. Salts and Sulphurs from mines	
8. Gum	
9. <i>Farfir</i> (Purple product resulting from alchemical operations)	

⁵⁹ The significance of this name merits discussion. Can it refer to a belief that Alchemy started in Western Asia Minor during Hittite rule (*c.* 2000–717 B.C. when Carchemish was captured by the Assyrians) or was some substance, thought to be essential for alchemy, obtained from Magnesia? Zosimos, however, suggests (*Festugière, op. cit.*, p. 245) that, *c.* A.D. 300, natural Magnesia came from Cyprus.

In the *Asfīdūs* treatise, no apparatus is mentioned. As for substances, the following names occur ; but many of them are probably metaphorical.

Gold	Vinegar
Silver	Sea Water
Copper	Sea Salt
Burnt Copper	Milk
Iron Rust	Milk of a Bitch ⁶⁰
Mercury	
<i>Maghnīsiyā</i> .	

The following Table includes the substances and apparatus mentioned in the Treatise of *Jāmāsp*.

Substances		Apparatus
Gold		Aludel (<i>Uthāl</i>)
Silver		Cucurbit and Alembic (<i>Qar</i> ^c
Burnt Copper		and <i>Anbīq</i>)
Iron Rust		Cups (? Glass— <i>Kīzān</i>)
<i>Maghnīsiyā</i>		Bottles, or Flasks (<i>Qannānī</i>)
Lime		Mortar (<i>Hāwan</i> —Persian)
Vinegar	} All Synonyms for ' Moist Spirit ' and ' Fiery Poison '	Mould (Spherical— <i>Kurah</i>)
Salt		
Wine		
Sea Water		
Milk		
Milk of a Bitch		
Mercury		
Ferment of Gold		
Clear Flower		

The disappointing result of this analysis of the practical content of the three treatises was, of course, only to be expected in view of the frequent warnings to the persons for whom they were written not to divulge the secrets of the Art to any but initiates. Being, in essence, a psychological extension of metallurgical technique, Alchemy can never have met with approval from the Mesopotamian craftsmen who dealt with the products of the mines that lay in the hinterland to the N.W., N. and N.E. of *Ḥarrān* : but seeing that these early alchemical treatises throw so little light on laboratory practice, where can we hope to find details of the almost modern degree of chemical knowledge that was revealed as existing in 2700 B.C. through Woolley's discovery in 1926 at Ur of the Chaldees of the Electrum Spearhead ? This was made of an alloy of 30% gold, 60% silver, and 10% copper, but the surface so obviously contained a larger proportion of gold that, at first, plating was suspected.

⁶⁰ This term is also found in use among Greek alchemists (cf. Berthelot, *Coll.*, II, 184, 12).

As, however, no demarcation line could be detected between surface and core, the only possible conclusion was that after the alloy had been prepared and the spearhead cast, the implement had been subjected to treatment by chemical reagents to remove excess of silver and copper. The surface was then burnished and consolidated so thoroughly that the effect of modern electro-gilding was produced ⁶¹.

However destructive wars, and the resulting downfalls of Mesopotamian and Hittite dynasties, may have been to the knowledge of metallurgical and chemical technique so clearly demonstrated by the Ur Spearhead, it is almost inconceivable that this knowledge could have completely disappeared from human ken. It is far more likely to have continued to exist: and indeed—as Holmyard has shown ⁶²—evidence of what may be described as reasonably sound scientific theory and practice can be found even in that fantastic hotchpotch of arithmological dream and alchemical procedure—the Jabirian *Corpus*. It was left to Ar-Rāzī (c. A.D. 900) to separate the wheat from the chaff and, with the help of his predecessor, Sālim al-Ḥarrānī, to embody first, in his *Madkhal at-Ta'limī* and then in the *K. al-Asrār* ⁶³ all that still survived in Ḥarrānian tradition of Hittite and Sumerian chemical science.

Although Ar-Rāzī more than once refers to Jābir ibn Ḥayyān as his Master, the *Corpus*, in its present re-edited and extremely composite form, will remain an almost impossible source of information until a succession of scholars like Kraus are able to break it up into its constituent parts, and pick out those of actual scientific value. The Latin translation of the LXX, if again re-examined, and collated with the Arabic, would, however, probably yield a useful amount of ancient Chemical treasure-trove. An even more likely repository of Ḥarrānian science are the alchemical writings that pass under the revered names of Socrates, Plato and Aristotle. Kraus's objection that they could only have been written in Muslim times, when the real teaching of these philosophers had been almost forgotten, may be satisfactorily met by considering how the Treatise of Agathodaimon probably came into existence. The slightly Hellenised phraseology of this treatise suggests that the author may have been a pupil of some Ḥarrānian alchemist in Seleucid times, and that it was first written in Greek—the new Court language—for the information of other Greek-speaking adepts. It may then have occurred to Syrian alchemists that the best way of avoiding inconvenient questioning, or too much interference by the local authorities in their alchemical researches, would be to associate their beliefs with the names of one or more of the leading Sages of their Greek overlords ⁶⁴.

⁶¹ *Antiquaries Journal*, 1928, VIII, p. 24. The date of the spearhead is that now considered by Sir Leonard Woolley to be preferable to the one given in 1928.

⁶² Jābir ibn Ḥayyān (*Proc. Roy. Soc. of Medicine*, 1923, XVI, pp. 55–57).

⁶³ *Memoirs A. S. B.*, 1927, VIII, *passim*.

⁶⁴ A similar procedure was followed by the Ḥarrānians when ordered in A.D. 833 by the Caliph Ma'mūn to become Muslims. By taking the Qur'ānic race-name Ṣābiān, they were able to claim to be 'People of the Book' (and so to retain their ancient Pagan religion).

From the occurrence of Buqrāt's name in a Cairo Arabic text of Zosimos—not to mention the references to Socrates, Plato and Aristotle in the Greek alchemical texts published by Berthelot—it is probable that such pseudographs were already in circulation early in the Christian era : while it is even more certain that, to Jābir, not only did Socratic science represent the highest degree of alchemical knowledge, but the Theory of the Balance could only be understood by students of the mental calibre of Socrates and Agathodaimon ⁶⁵. In fact we find even Kraus himself suggesting that similar texts of Plato to the one that forms the subject matter of the 3rd treatise of Jābir's *Musāhḥaḥāt* (see p. 6 of this paper) possibly originated from Ḥarrān.

A careful study of the texts of any Latin or Arabic treatises on alchemy ascribed to one or other of these three Greek philosophers would probably yield a good deal of useful information regarding the scientific knowledge of the ancient inhabitants of Mesopotamia.

The position of Democritus, the Alchemist, in the chain of ancient teachers in Egypt and the Middle East.

Tradition is far from negligible in the East : and although Festugière is inclined to regard as phantasy the tradition that the alchemical Democritus (with his theories of transmutation based on the belief that change in the Elements is possible) was actually the Philosopher of Abdera (460–370 B.C.), who regarded matter as made up of indivisible—and therefore unchangeable and eternal—mobile particles, one has heard of distinguished men, like St. Augustine and Ibn Sīnā, who professed almost diametrically opposite opinions at different periods of their lives. The quotations given below at least, suggest the desirability of considering once again the possibility that Democritus of Abdera may actually have written treatises on alchemy during his residence in Egypt, with the object of recording the views of his teacher, a Persian alchemist called Ostanēs. It is certainly possible for them both to have been in Egypt in the last quarter of the 5th century B.C., as Egypt was then a Persian province, and had been for the previous century ⁶⁶.

⁶⁵ Kraus, *op. cit.*, II, p. 52.

⁶⁶ The references in the 'Natural History' of Pliny (d. A.D. 79) to Ostanēs and Democritus may be noted in this connection. In XXX, 2, after assigning the beginning of Magic to the Persian Zoroaster, Pliny goes on to mention two magicians bearing the name Ostanēs, one at the time of the invasion of Greece by Xerxes (480 B.C. and thus, possibly 20 years before the birth of Democritus) and another who is said to have accompanied Alexander the Great in his conquest of Asia (i.e. c. 335 B.C.). Democritus, Pythagoras, Empedocles and Plato are linked together as having learnt about this branch of knowledge during their travels ; and Democritus is stated to have particularly concerned himself with the writings of Apollobeches (of the town of Copt in the Egyptian Thebaid) and of the Phœnician Dardanus. The writings of the last named had been found in Dardanus' tomb.

Earlier in the 'Natural History' (XXV, 13), both Pythagoras and Democritus are said to have written about the magic virtues of plants in accordance with the teachings of Persian, Arab, Ethiopian and Egyptian Magi.

(1) Ar-Rāzī in the *Shawāhid* ⁶⁷ quotes Apollonius of Tyana (1st century A.D.) as stating that when Democritus accompanied Ostanēs to Egypt, they found Egyptian alchemy to be based on the theory of Hermes that it had proceeded from 'The One Thing'. The principal substance employed by Egyptians at that time was the Brain of the Pig, owing to the similarity of pigs' brains to those of mankind. As the visitors believed that Eggs contained the same Essential Nature (*kiyān*) as brains, and gave the same result, they pointed this out to the Sages of Egypt, who accepted the suggestion—in spite of the alchemical manipulation of eggs being somewhat difficult. The aphorism that resulted from this practice "He who acquires the Philosopher's Egg must succeed, for it is the 'Tincture', and is found in every house", is evidently based on Hermetic theory, however much the use of organic materials violated the prohibition by Hermes of anything except substances of mineral origin. The comment of Ar-Rāzī that by Philosophers' Egg the Hair was meant, as well as the failure of Ostanēs to be surprised at the use of brains, suggests that—if the companion of Ostanēs was Democritus of Abdera—before the end of the 5th century B.C., a rival Persian school of alchemists to that of Ḥarrān had discovered the chemical activity of *Sal-Ammoniac* ⁶⁸ and that, as this reagent could be made by the distillation of organic substances, these might, with advantage, take the place of mineral substances in alchemy. Ar-Rāzī adds that as Eggs could be obtained for a trifling price, this confirms the saying of *Democritus* about a 'Stone that is not a Stone'.

(2) Zosimos in the same Cairo MS. remarks: "Democritus the Sage has said: They (the alchemists) have called this secret "The Egg": but all of them (really) mean "Mercury". Later he adds: "The Ten that overcome 'The One' are the Colours that proceed from the 'Tincture of the Egg'. This is not found save in the 'Sea of Egypt', and it is its Water."

(3) In another Cairo MS. ('Treatise of the Secret to Theosebeia'), Zosimos also mentions that the ten Processes, to which the Sage Democritus gave different names, are, in reality, only one Process, and result in a single compound (*murakkab*). Zosimos states further that Democritus declared that nothing

⁶⁷ Rampur MS.: described in *Mem. A. S. B.* 1910, III, pp. 68-73.

⁶⁸ *Sal-Ammoniac* was known to Zosimos, and so valued by him that he regarded it as the 'Stone' i.e. Elixir (see later: Appendix B, note 74). A still earlier reference to it under its Chinese name *Nao*, is to be found in Wei Po-Yang's alchemical treatise, written about A.D. 142. For this, see Lu Ch'iang Wu's translation in *Isis* (XVIII (2), p. 257), where the absurdity of treating a boil with a 'hot' substance like *sal-ammoniac* is mentioned—seeing that the heat in a boil can only be reduced by something cold. For the root-meaning of the Chinese word, see also the writer's paper on *Sal Ammoniac* (*Mem. A.S.B.*, 1905, I, p. 41).

In view of the simple character of the Chinese name, the suggested interpretations of the Arabic word *Nūshādūr* as 'that which drinks the fire' (Ruska) or 'inextinguishable fire' (Mazahari) seem doubtful. Campbell Thompson (*Dict. Assyri. Chem. and Geology*, p. 12) may have been right in his belief that *Sal-Ammoniac* was known to the Assyrians.

was more difficult for alchemists than Combination (*mizāj*), resulting in the conversion of the 'Natures' into a single 'Mercury' (see Agathodaimon Treatise *passim*).

(4) According to the 4th century A.D. Greek alchemist Synesius, Democritus wrote four books on Alchemy—one of them being his '*Physica et Mystica*' (Festugière, *op. cit.*, pp. 224–5). They dealt with the 'Tincturing' of Gold and Silver; with Stones; and with the preparation of the 'Purple'.

(5) The same Greek (*idem*, p. 262, n. 3.) writer ascribes to Democritus a saying also found in Zosimos: "(By alchemy) you will conquer poverty—that incurable malady." In Agathodaimon's treatise we find a sentence to the effect that alchemical knowledge "drives away poverty in this world and will bring great reward in the next": while Jāmāsp informs Ardashīr that, owing to their possession of the Secret, "the Sages are preserved from poverty and hunger".

Finally—

(6) Insufficient attention seems previously to have been drawn to the reference of Zosimos (quoting Ostanēs—Berthelot, *Coll.* II, p. 129), to *Sophar* the Persian, teacher of Ostanēs the Mede.

The name *Sophar* may have subsequently been perverted into *Asfidūs*, the author of the almost duplicate treatise to that of Jāmāsp, in which case it would seem more likely that Jāmāsp copied from *Asfidūs*, rather than *vice versa*.

From the verified quotation from the treatise of *Asfidūs* in the *Mā'al-Waraqī*⁶⁹: "Take the things from their mines and raise them to their highest places and reap them from the tops of their mountains and return them to their sources"—coupled with Ibn Umail's subsequent denunciation of alchemists who waste their time trying to use hair and other animal substance (which, probably, was also borrowed from *Asfidūs*)—we may conclude (a) that *Asfidūs* was a follower of Agathodaimon in employing only mineral substances in alchemy; and (b) that already, in the time of *Asfidūs*, there may have been another school of alchemists, who used animal instead of mineral, substances.

As already noted, the use of organic substances in alchemy may—if Ar-Rāzī's quotation from Apollonius can be trusted—have begun as early as the 5th century B.C. Moreover, Bolos, c. 200 B.C., seems to have written on the medicinal use of animals, and as this can be taken to imply a parallel use at that date of animal products in alchemy, it would fit in with Apollonius' story—unless of course (as Festugière suggests) Bolos was responsible for inventing the entire legend of Ostanēs and Democritus. On the other hand, the close resemblance between the treatises of *Asfidūs* and Jāmāsp suggest that these two writers were more or less contemporary. Subject to the uncertainty as to whether *Asfidūs* comes before Bolos or after that writer, the tentative historical

⁶⁹ Cf. *Mem. A.S.B.* XII, pp. 141–2. Ibn Umail explains the phrase as referring to the process of sublimation in the Cucurbit and Alembic.

order of the different writers on Alchemy in the Near East that we have been considering, down to A.D. 300, will be :—

1. HERMES,
2. AGATHODAIMON,
3. (or 4) MARY, the Jewess (date uncertain : but quoted by Ostanes),
4. (or 3) SOPHAR,
5. OSTANES,
6. DEMOCRITUS,
7. BOLOS,
8. (or 9) ASFĪDŪS (i.e. the writer of some treatise purporting to be by SOPHAR),
9. (or 8) JĀMĀSP,
- and 10. ZOSIMOS.

Summary.

The inferences and conclusions that have been drawn from the facts in the preceding pages may be summarised as follows :—

1. The number 28, as well as the sequence of numbers 1, 3, 5 and 8, with their total of 17, that were adopted by the writer of the Jabirian ' Books of the Balances ' as the fundamental numbers in Nature, are those found in the 9-Magic Square. When this is analysed by the use of the Pythagorean *Gnomon*, as in the following sketch, the gnomonic total is seen to be the Perfect Number 28.

4	9	2
3	5	7
8	1	6

The numbers in the remaining four compartments of the Magic Square are 1, 3, 5 and 8, the total of which is 17.

2. This 9-Magic Square is found in China from—possibly—1000 B.C., as the ground plan of the *Ming-Tang*—the Ducal (and, later, Imperial) Temple

of Mystic Enlightenment : but this plan may have been derived from some other country lying to the West of China.

3. From the numbers assigned to the Elements Water, Earth, Fire and Air (quoted by Kraus in his *Jābir ibn Ḥayyān* II, 219) it is clear that this Magic Square was known in Europe to Theodorus, a pupil of the Neoplatonist philosopher Porphyry (A.D. 233–305). Moreover, J. Carcopino, in his recent (1948) article in *Museum Helveticum* (V, 16–59) on 'The Secret Christianity of the Magic Square', has shown that a lettered form of the 25-square was used by Christians to symbolise their belief in Christ as early as the last quarter of the 2nd century A.D.

4. In Agrippa's *De Occultā Philosophiā*, published at Cologne in 1533, the 9-Magic Square is assigned to the Planet Saturn, and the metal Lead. The next six Magic Squares are also each assigned to a Planet and a Metal. The order in which these are arranged is that in use by the pagan inhabitants of the ancient Syrian town of Ḥarrān, who—towards the end of the reign of the Caliph Al-Ma'mūn (A.D. 813–833)—adopted the race-name of Šābians.

5. The late Sir J. C. Coyajee⁷⁰ showed that the hierarchy of Muslim Šūfis was almost certainly derived from the numbers assigned to the Halls of the *Ming-Tang* (or at least from the numbers that make up the 9-Magic Square). This may be of considerable importance in the history of Alchemy in view of the facts :

(1) That the ordinary title of Jābir was Aṣ-Šūfī ; (2) that he was acquainted with this variety of Magic Square, and (3) that his reputed Master, Ja'far aṣ-Šādiq (who died in A.D. 765) is also included among the earliest Šūfis by the first writer (c. A.D. 1070) on the history and tenets of Šūfism.

6. Subject to any subsequent discoveries from excavations in Mesopotamia, Irān, Kurdistān, or Asia Minor, it now seems probable that Alchemy originated either in Mesopotamia, or in some other country of the ancient Middle East where Metallurgy had already reached a high level of excellence.

7. The beliefs of the Ḥarrānians regarding Alchemy may be taken as those formulated in the *Treatise of Agathodaimon*, in which it is laid down that only mineral substances should be used in the preparation of the Elixir. The contents of this treatise as it now exists in an Arabic translation suggest that it was written in Seleucid times (4th–1st century B.C.) under Greek influence : but as the theory found in it exhibits every sign of maturity, the quest for the Elixir may have begun many centuries previously. It even seems possible that Alchemy may have been first practised in the Age of Copper, i.e. before 1200 B.C. The idea of converting Copper by suitable treatment into Gold could have occurred to any person with a philosophic bent of mind, and all that was then necessary was to persuade some King to supply the necessary funds and materials for experimenting.

⁷⁰ *Journal As. Soc. Bengal* 'The Sraosha Yasht' ; N.S. XXVIII, p. 227, *et seq*

8. From Ḥarrān, Alchemy spread to Egypt, where it underwent modification
(a) by ideas derived from Irān ; and

(b) under the influence of Neo-pythagorean and Neo-platonist philosophy.

The first certain writer on alchemy in Egypt was Bolos (2nd century B.C.).

9. As for the possibility that Alchemy may have originated in China, the first reference in ancient Chinese records is not to the conversion of base metals into Gold but that the Emperor who built the Great Wall in the last quarter of the 3rd century B.C. heard that an Elixir of Life was known to people living in three islands in the Eastern Sea. A naval expedition in search of these islands set out, but never returned. Later, in the time of the Hān Emperor Wu-Ti (156–87 B.C.) a Chinese is said to have interested the Emperor in the preparation of Gold from Cinnabar, by alleging that if the Emperor made utensils for eating and drinking from the metal thus produced, he would be able to visit the islands of the Eastern Sea, and, like their inhabitants, become immortal⁷¹. As the Emperor ultimately died, presumably the alchemical 'sacrifices to the furnaces' that he is recorded to have personally made were fruitless. Quite apart from the great difference that is evident between the very primitive Chinese ideas on Nature and the Elements, and those of the West, the identity of the materials used by actual Chinese alchemists of later date as well as the fact that the earliest Chinese texts only date from the early centuries of the Christian era, clearly indicate that the Chinese knowledge of alchemy must have been derived from some country to the West of China.

Finally :

10. The evidence adduced in this paper appears equally clearly to indicate that the part played by Greek philosophers between 600 and 350 B.C. was that of re-stating and elaborating in language suited to the Western mind ideas of greater antiquity that they had acquired in Egypt, Syria and Asia Minor. For most of this period, all these countries were included in the Persian Empire.

APPENDIX A.

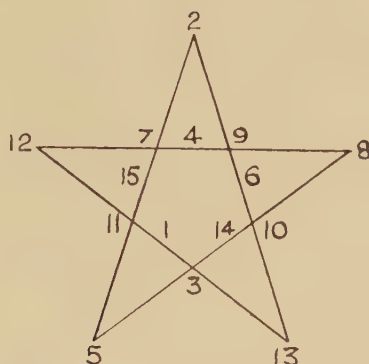
That the 9-Magic Square possibly originated from the same ultimate source as the Pentagram⁷² badge of the Greek Pythagorean Brotherhood which flourished as Crotona in Southern Italy from about 525 B.C. may be seen from

⁷¹ For these accounts of Alchemy in China during the 3rd and 2nd centuries B.C. see the 1932 *Isis* paper of Lu-Ch'iang Wu and Tenney L. Davis (pp. 226–7) quoting from Sz-ma Tsien's *Shzh-ji* ('Historical Memoirs') compiled around 100 B.C.

⁷² Mathematically, this is the figure formed by producing the sides of a Pentagon both ways until they intersect.

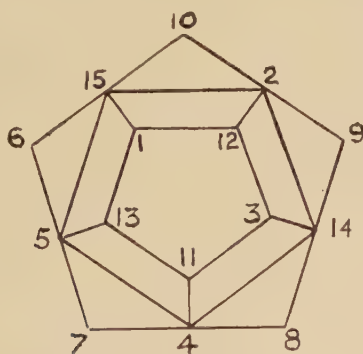
The Pentagram appears prominently on both sides of a spouted ewer, found at Jemdet Nasr in southern Mesopotamia and now in the Ashmolean Museum, Oxford. A reproduction is to be seen as Plate XIV (a) of Gordon Childe's 'New Light on the Most Ancient

Tarry's numerical explanation of its meaning that is reproduced on p. 21 of Cazalas' volume.



In this case, the sum of the numbers (a) at the points of the Pentagram ; (b) at the angles of the enclosed inverted Pentagon : and (c) assigned to the five sides of the Pentagon, is in each case 40, i.e. the same total as that of the circumferential numbers of the 9-Magic Square.

This does not by any means exhaust the arithmological possibilities of the pentagon as may be seen from the following diagram of Salomon's double pentagon reproduced on p. 166 of Cazalas' book, and extended to include three instead of Salomon's two pentagons.



In this case, again, we find that the sum of the numbers attached to the angles of the three pentagons is, in each case, 40.

East' : and as the ewer dates from earliest Sumerian times, i.e. 3000 B.C., this confirms the idea already mentioned (pp. 9 and 20, n. 37) that Pythagorean philosophy was based on theories already current—perhaps even for millennia—in the Middle East.

From the Table on p. 24, it will be seen that the Pentagon was associated at Harrân with the chief local deity, the Moon : while the geometrical plans of all the other Harrânian Planetary Temples may be regarded as ultimately made up of triangles.

APPENDIX B.

Summary ⁷³ *of the Cairo Arabic MS. of the Treatise of Agathodaimon : his discourse to his disciples when he was about to die.*

The Heavenly Art depends only on the 'One Thing' from which this Noble Stone proceeds. To acquire the necessary knowledge from among the sayings of Hermes given in his books, the student should confine himself to the one secret-illuminating sentence "This 'Stone' by which the Work is performed is a Stone and not a Stone". "This 'Noble Stone' which God has bestowed on us" ⁷⁴ is not one of the ordinary stones, seeing that it melts and comes out as the Essential Nature (*kiyān*) ⁷⁵ of the stones—a Clear Water and a Pure Spirit. After being mixed with whatever is necessary and heated, it coagulates into the 'Etesian Stone' ⁷⁶, through which alone Tincturing is

⁷³ From a translation made many years ago with the able collaboration of the late Shamsu-l-ʿUlamā' H. Ḥusain. The Zosimos notes are drawn from a précis by M. Turāb ʿAlī of the Arabic works ascribed to Zosimos that exist in the Royal Library, Cairo. Copies of these Arabic texts are now in the Library of the History of Science Museum, Old Ashmolean, Oxford.

⁷⁴ This sentence (as well as that which precedes it) is quoted by Zosimos in an Arabic translation of one of his treatises to Theosebeia (Cairo MS. ascribed to Sālim al-Ḥarrānī, though only the first page is by the latter). Zosimos' statements show clearly how alchemical belief had retrograded since the time of Agathodaimon. For Agathodaimon, the Vital Spirit of the Elixir, or 'Stone', proceeds from the 'One Thing' "found among both rich and poor, and from which no spot in the market is free". This is also quoted by Zosimos (see also Berthelot, *La Chimie*, III, 124—Safinjā and Marqūnis): but in spite of Agathodaimon's denial that the 'Stone' can be obtained from animal or vegetable substances, Zosimos apparently believed that Agathodaimon was speaking figuratively and that he really meant Urine or Dung, from which Sal-Ammoniac can be obtained. Zosimos actually says: "In my opinion, it (the 'Stone') is Sal-Ammoniac." Moreover, under Christian influences, the Mesopotamian dualism of 'Body' and 'Spirit' had become, with Zosimos, the Pauline triad 'Body', 'Soul' and 'Spirit'.

From the reference to the 'Stone, common in the market place' that occurs in the first of the two couplets ascribed to Khālīd ibn Yazīd, quoted on p. 62 of *M.A.S.B.*, 1910, III, it would seem that Khālīd (or whoever was the actual author of these verses), was acquainted with this treatise of Agathodaimon.

⁷⁵ For a discussion of the meaning of *Kiyān* (= *φύσις*), see the translated extract from the treatise of Sālim al-Ḥarrānī in Ar-Rāzī's *Shawāhid* (*Mem. A.S.B.*, 1933, XII, p. 135).

⁷⁶ In the Cairo Arabic MS. of the work previously mentioned, Zosimos refers to the Etesian Stone as resembling Marble in its extreme whiteness, whereas Agathodaimon compares it with Snow. This is in accordance with the derivation of the Agathodaimon treatise from Ḥarrān, which has snow-capped mountains on both N. and W., while snow is practically unknown in Egypt.

As E. J. Holmyard pointed out in a note appended to his paper on Abū'l-Qāsim al-ʿIrāqī (*Isis*, 1926, VIII, p. 426), the Arabic *āīsūs* is the Greek *ετήσιος*, 'annual': Zosimos himself in one of his other treatises entitled 'The Keys of the Art' explains that this 'Stone' (or Elixir) was so called because it was re-born every year. This shows how the early alchemists linked up the theory of their Art with natural phenomena—in this case with the annual re-birth of vegetation under the fertilising influence of the Sun. Similarly the *Inā'* or *Alembic*, in which the 'Stone' was born from the union of 'Body' and 'Spirit',

possible. Copper, when treated as science prescribes, becomes Silver, and—after further treatment (addition of liquids, trituration and repeated coction)—Gold.

Instructions follow regarding mixing the 'Stone' with the 'Mercury' (i.e. Spirit) of the 'Burnt Body' (or Ashes) according to the (prescribed) weights of the Art, and exposing the moistened mixture to the Sun ⁷⁷, taking care to keep the 'Mercury' in moist union with the 'Body' till it becomes soft, fusible, and divided into its Elements, as if the moisture diminishes, the Tincture will be imperfect. Fire being the greatest enemy to the success of the operation, extreme attention has to be paid to the degree of heat that is employed, in order to prevent the Moisture diminishing to such a degree that the 'Body' will not afterwards accept the 'Spirit'.

The rest of the treatise consists chiefly of instructions given by Agathodaimon at the request of his disciples, who asked from what the 'Stone' is obtained, what are its properties, and how the Art is to be carried out by experiment (*tajribah*).

In reply Agathodaimon told them that the Art was bestowed by God on Shīth ibn Ādam ⁷⁸, who was ordered not to impart his knowledge to anyone. This 'Stone'—the 'Light of the Earth' that serves as a guide to Created things and makes hidden things manifest—is most resistant to fire, which only makes it purer and more excellent. "Earth does not cause it to decay or undergo corruption, on account of what the Creator has combined in it." During the operation, various colours appear: Red, Yellow, White, Black and Green ⁷⁹. Its taste is sweet like blood; its smell pleasant; and it was modelled on the womb, while the 'vessel with a nose', or retort, represented the placenta. Association with the idea that the vehicle of man's Spirit is his blood is also evident from the comparison (in the *Mafāṭih-u-l-'Ulūm*) of the top half of the alembic with a cupping glass, in which the vapourised 'Spirit' from the mixture that is being heated in the lower half collects. (Cf. *M.A.S.B.*, III, 62, n. 3: and the present paper, n. 57. p. 29.)

⁷⁷ This is an echo of Ḥarrānian belief in the astrological effect of the Sun on the operation. Gold being the metal of the Sun, the Sun's rays would facilitate the production of the Elixir for Gold.

The subsequent cautions about the degrees of Fire to be used and the avoidance of the 'Enmity of Fire', remind one of Zoroastrian Fire Worship, and its predecessor, Sun Worship. Festugière (*op. cit.*, p. 242) mentions that, in one Greek MS., Hermes actually refers to Fire as 'The Great God'.

⁷⁸ This corrects the mis-statement of the Arabic writer Ad-Dimashqī that Agathodaimon was Shīth. Zosimos omits any mention of Shīth, and says God taught 'our Father Adam'. For a lengthy discussion of the name Adam by Zosimos cf. Festugière (*op. cit.*, pp. 268–272). This treatise of his to Theosebeia purports to deal with Apparatus and Furnaces, but consists mostly of a series of mystic commentaries on the Greek letter Ω. By this Lead may be meant. Festugière suggests that Zosimos' 28 Books on Alchemy (of which this is one) dealt with the Planets (and their associated metals), starting with the Moon and ending with Saturn. If so, Zosimos was following the Ḥarrānian order, but in reverse arrangement.

⁷⁹ These are the Primary Colours of the Chinese who regard yellow as the colour of the Centre (Granet, *op. cit.*, p. 234; but see also *supra*, p. 19, n. 33, for *azure* instead of *green*). Democritus recognised only four of these colours as Primary—omitting yellow.

originates from the Earth, where there is temperate heat, proper combination, and the dust is loose and moist. It is the densest of all things. The initial operation is very difficult, and can only be accomplished after many days of coction, trituration, and repeated heating after the addition of moisture. Much patience is needed during the first stage of Washing, Whitening and Rusting. The order of change in colour in this case is from Whiteness to Redness, any Blackness at first present in the *Jism* (inorganic matter) being removed, and the *Jasad* (matter capable of being endowed with a Spirit) thus whitened.

Admixture is, in the first place, between the 'Water' and the 'Earth', and the 'Body' and the 'Spirit': and, secondly, between 'Water' and 'Water'. Combination is then effected by means of Fire, so as to unite the 'Natures' into a 'Single Thing'. When the 'Body' has been reduced to fine particle like ashes, "Blackness will most rapidly change into Whiteness by which the Noble Boon, and auspicious and great Gift (of God) will be attained". Details follow regarding the Receptacle (*inā'*) that is to be used; the heat of the fire—like that of a brooding hen⁸⁰—and the all important separation of the Spirit by solution "so that no grossness of Nature will remain . . . and its *Kiyān* (Essential Nature) will have disappeared".

The secret of the Art (which had not previously been hinted at, even by using the mystical language employed by Agathodaimon) is the removal of grossness, and reduction of the material used to a state of subtleness, without which Tincturing is impossible. The agent for effecting this is the 'Fiery Poison'⁸¹ extracted from the 'Natures' by means of Fire. Details are then given of the treatment of Copper⁸¹ with this Poison till the 'Single Gum'⁸² or product, white as snow, is obtained, which the 'Sages' have called 'The White'. This is placed in a retort and heated, first on hot ashes from burnt horse dung, till the blackness that again appears ceases to be seen, and then on

⁸⁰ This phrase was quoted by Zosimos in another treatise 'On the Explanation of the Ten Preparations (Cairo Arabic MS.: see *Mem. A.S.B.*, 1933, XII, p. 137, col. 2, note). It is ascribed to Hermes in Aras' discussion with the Byzantine Qaiṣar quoted in the *Mā'al-Waraqī* (*idem*, pp. 132-3) but in Al-Ḥabīb's treatise (Berthelot, *La Chimie*, III, p. 104) to Agathodaimon.

⁸¹ These paragraphs were used by Zosimos in some other treatise, as shown by a quotation in Ar-Rāzi's *Shawāhid*. In this, it is stated that the destruction of the grossness of Copper by the 'Fiery Poison' should continue until nothing remains in it except the Tincturing Spirit, and the whole becomes Poison (*Mem. A.S.B.*, XII, pp. 138-9). See also *La Chimie*, III, 106, for a reference to Copper by Agathodaimon.

⁸² In other words, an *Argyrokolla*—comparable to the Hermetic *Chrysokolla* (*cf.* Festugière, *op. cit.*, p. 242—quoting Berthelot's *Alchim. grecs.*). Even though a visible product resulted from the operation that was being carried out, the word *kolla* (gum) may be interpreted as symbolising for the alchemist the operative Power of the Demiurge inherent in Matter, whereby the constituent opposites of 'Body' and 'Spirit' are linked together in the White or Red Elixir. The parallel in modern chemistry is atomic 'valency'.

a fire of horse dung. After the product has again been transferred to the other instrument, and similar processes of heating, distillation and drenching carried out for a lengthy period until no blackness remains in the 'Nature' of the substance, the 'Royal Colour' appears—the wonderful *Farfīr* (Purple)⁸³, "from which comes the Complete Tincture which Eternity and lapse of time cannot efface. Neither Water nor Fire causes it to perish, nor will it decay or change as long as the world abides". One *mithqāl*⁸⁴ of this is sufficient to transmute an unlimited quantity (of whatever has to be changed into Gold).

The treatise concludes with renewed warnings about the 'Enmity of Fire': the need for subjecting substances to 'decay' (*ta'fīn*) by many days' exposure to the heat of moist horse-dung so as to reduce the compound (*murakkab*) to fine soft particles: and the need for removing the 'Spirit' by means of solution. Patience is again enjoined both for the operation, and in understanding the writer's enigmatic language. The students must be of good understanding, lovers of wisdom and—besides studying books of the Sages—they should be willing to devote themselves to prolonged meditation.

⁸³ See Festugière, *op. cit.*, p. 242 (quoting from Berthelot). According to Hermes, writing in his treatise entitled 'The Little Key', the ancients meant by 'Purple' and the 'Purple Stone' the 'Rust of Copper'. Another name for it was apparently *Comaris*. These names did not imply that Verdigris was the Elixir, but referred to any preparation of any substance that was believed to be of use for the preparation of the Elixir. By the action of Fire, the Spirit (or 'Mercury') of the materials employed was liberated, and by subsequent suitable operations—chiefly solution and further heating—the Spirit was re-united with separately purified Matter into an Elixir. This was believed to possess to some extent the creative and transforming energy of either 'The All', or at least of 'The One', i.e. the Demiurge.

⁸⁴ A small weight—24 carats.

JOHANNES BANFI HUNYADES 1576-1650.

By F. SHERWOOD TAYLOR and C. H. JOSTEN.

Introductory.

ONE of the authors of this paper (F.S.T.) recently received a communication from Miss M. A. Braddock of Stubbins Lea, Chinley, concerning a painting on glass depicting an alchemist, Johannes Banfi Hunyades, and dated 1646. The painting proved, like most glass-paintings, to have been made by sticking an engraving on glass, rubbing down the paper and painting on the back of it; further investigation showed that portraits of Banfi Hunyades had been engraved by W. Hollar ^{1,2} and W. Marshall ¹. These portraits are reproduced in Plates I and II. The engravings by Hollar are dated 1644, that by Marshall 1646. Miss Braddock's painting on glass corresponds to the latter.

It is probable that the earliest of the Hollar portraits was that illustrated as Plate I *a*: Plate I *b* and Plate I *c* ² seem to represent a superior rendering of the subject and it may be thought that I *c* with its more extensive inscription is a later state of I *b*. The latter was reproduced by W. Richardson, 31 Strand, in 1799.

The Marshall engraving (Plate II) differs appreciably from Hollar's and would appear to be derived from a different portrait.

Inscriptions on the engravings.

The inscriptions on the portraits give us much of our information concerning our subject. They are as follows:—

I *a*. Inscription in the panels of the frame of the portrait, reading clockwise:

- (i) Coeli enarrant Gloriam Dei fortis Ps. 19.
- (ii) Est in Mercurio quicquid quaerunt sapientes.
- (iii) Fac fixum Volatile & Volatile fixum & habebis Magisteriū.
- (iv) Inventionum Regula proportio.

Below:

- (v) Effig: Johan: Banfi Huniades Riuuliensis Ungari: Olim Anglo-Londini in Illustri Collegio Greshamensi Hermeticae Disciplinae Sectatoris & Philo-Mathematici.

¹ F. O'Donoghue, *Catalogue of Engraved British Portraits preserved in the Department of Prints and Drawings in the British Museum*, 1908, vol. i, p. 112.

² This engraving is numbered 1358 II in the Collection of Engravings at Windsor Castle.



Effig: Joh: Banfi Humades Raumbensis Vn:
sari olim Anglo Londini in illustri Collegio Gref:
taniensi Hermeticæ Disciplinæ Sæctoris & Philo:
sophiæ præfati



F. G. Johan Benji Hynaees Boudhuysen Vngari; Olen
Anglo London in Libary College Graham Smith's Home;
New Dillingham, Scotland & Phil. Antiquaries.

Above :

Aetatis suae 68. 1644.

Signed : W. Hollar fecit.

I b. Inscription in the frame of the portrait :

(i), (ii), (iv) as in I a above.

(iii) Johannes Banfi Huniades Rivuliensis Ungarus, olim apud Anglos in Illu : Coll : Londino-Greshamensi Hermeticae Disciplinae Sectator et philomathematicus.

On frame, at base :

Aetat. suae 68. 1644.

Signed : Gowy³ deli : W. Hollar fecit aqua forti 1644.

I c. Inscriptions in the frame of the portrait :

As in I a except that for *Volatile* is written *Volatilo*.

On frame at base :

As I b.

Below :

As in I a (v) but with minor differences of abbreviation.

Signed : Gowy deline : W. Hollar fecit Londini.

II. Inscription in the frame of the portrait reading clockwise :

(i) Fac mercuriū per mercuriū, qui dissolvit et aperit naturas seratas : Rosar : pag : 320.

Nisi corpora incorporea feceritis, et incorporea corporea non dum regulum operandi invenistis. Arnold. p. 483.

(ii) Scito te nihil creare posse, quod solius Dei proprium est, sed res occultas in umbra latentes facere apparentis et umbram ab illis tollere, hoc philosopho intelligenti à Deo p natura concessum est. Cosmopolita. pag : 73.

(iii) Occulta manifesta et manifesta occulta, et invenies Magisterium. Richard. Pag : 645.

Ungaria primo me genuit : Ungaria mihi patria est. etc. Basil : Val ; pag. 24.

(iv) Qui Aurum vel Argentum ita destruere norit, ut postmodū in Aurum vel Argentum reduci non possint, ille ad magisteriū pervenit. dict : Alan. pag : 768. Fac fixum volatile, et volatile fixum, et totū habebis magisteriū metallor : p. 509.

³ The painting does not appear to be extant. For details of Gowy, see U. Thieme and F. G. Willis, *Allgemeines Lexikon der Bildenden Künstler*, Leipzig, 1921. s.v. Gowy.

Below on frame :

Aetatis suae 70. 1646.

Below on scroll :

Est in mercurio quicquid quaerunt Sapientes. Clangor : pag : 466.
Instrumenta meliora non reperies quam Ungaria nec non Hystria
producunt. Tinct : phis : Cap : 4.

Below scroll :

Effigies Johannis Banfi-Hunyadi, Riouliensis, ungari, Hermeticae
philosophiae scrutatoris, et artis spagyricae Anglo-Londini professoris,
qui aurum et argentum destruxit, et reduxit in mercurium per
mercurium. Porro mercurium hunc praecipitavit sine ulla additione
in pulverem rubeum, in tali vitri forma, quale apparet in manu ejus,
Multiplicavit autem in ejusmodi vitris, quorum figurae à tergo ejus
sculptae. Fixum sine mercurio : fecit volatile : Corpora fecit
incorporea : Occulta reddidit manifesta : Soli Deo (invitis Zoilis) sit
honos et gloria. Gulielmi Marshallis fecit. Londini.

The portrait by Gowy from which Hollar's engraving was made is not recorded.

We learn from these engravings, then, that Johannes Banfi Hunyades was born about 1576 in Rivulus Dominorum, (Nagy-Banya ⁴ or Baia-Mare, i.e. Frauenstadt), that he became professor at Gresham College, that his pursuits were alchemy and mathematics, and that he claimed to have carried out certain operations on the metals, to be discussed in a later section.

Other information concerning Huniades.

William Lilly, the astrologer, dedicated his work *Anglicus, Peace, or no Peace* (London, 1645), to Huniades.

Letter of dedication, unpaginated :

" Amicissimo & eruditissimo Domino JOHANNI BANFI
HUNIADES, Riouliensi Ungaro, Philosophiae Hermeticae Anglo
Londini scrutatori, & artis Spargericae [sic] professori fidissimo &
excertitatissimo, S.P.D.

G. L.

Worthy Sir,

It is now more then eleven, and not full twelve yeers, since my good
Angel directed me to your happie acquaintance : Since which time,
I have ever admired those your excellent Parts in Chimistry, and
accounted it no small blessing to our Nation, that a man so learned,

⁴ I.e. ' Big Mines '.

and born so remote from us, as Hungary is from England, should live and continue amongst us English, and willingly give production to such rare Learning as yourself hath really done.

I love you not more for that exquisite knowledge God hath enabled you with, than for that innate candour and sincerity of heart which I have always observed in you. Is he living, and an honest man, that can say or complain you have performed lesse then you undertook? an Honour truly and really befitting your self, but few else, if any at all, Professors in Chimistry. The Hermeticall Philosophers have great cause to esteem you, for your own particular skill, experience, industry, ingenuity, modesty, reall perfection of sublime matters and conclusion, far above vulgar capacities hath made the world abroad, and the English Nation at home, sensibly know and discern, there's a validity and worth in that Art, which was shrewdly suspected before; whereby you have gained that esteem, both in England, and transmarine parts; That in this last Age, no man hath attained more, hardly any have parallel'd the learned Huniades.

God Almighty adde more yeers and knowledge unto you: and sith you will leave us (we being not worthy of you) he direct you in safety, untill you happily arrive to Claudianopolis, the Sepulchre of your fore-fathers. We shall be thankfull in England, that you have watered the many hopefull Plants, and besprinkled the understandings of many our Country-men with some of your curious Conceptions: So that although in person you leave us, we shall have cause to remember, that sometimes here lived amongst us, Johannes Banfi Huniades Hermeticae Philosophiae indagator solertissimus, whose usual word was, Est in Mercurio quicquid quaerunt sapientes ⁵.

Sir, myself shall account it no mean respect, if, as formerly, so still, you vouchsafe me your wonted love, and undertake the Patronage of this Book written

By your Astrologicall

London, 12 Decemb.

English Friend

1644

William Lilly."

It thus appears that Hunyades came to London as early as 1632 or 1633 and that he belonged to a branch of the family whose 'sepulchres' were at Claudianopolis (or Claudiopolis, i.e. Cluj, Koloszvár, Klausenburg, in Transylvania), and that, by 1644, he had formed plans to go home to Hungary.

The circumstances of the death of Huniades and his association with Arthur Dee are revealed by another document, a copy in Elias Ashmole's

⁵ Cf. inscriptions on engravings.

hand " of a Letter from D^r Thomas Browne of Norwich (after Knighted) written to M^r Ashmole in March 1654. Concerning D^r Arthur Dee " ⁶.

"

D^r Arthur Dee was a young man when he saw this Projection made in Bohemia but he was soe inflamed therewith, that he fell really upon that Study, & read not much all his lyfe but Bookes of y^t subject. and two yeares before his Death, contracted with one Huniades or Hans Hungar in London, to be his operator. This Hans Hungar having lived long in London, & growing in yeares, resolved to retourne into Hungary, he went first to Amsterdam, where he was to remaine ten weekes, till D^r Arthur Dee came unto him. The D^r to my knowledge, was serious in his buisnies, & had provided all in readines to goe, but suddainely he heard that Hans Hungar was dead ⁷."

Arthur Dee died in September 1651 and we may therefore conclude the year of the death of Huniades to be 1649 or 1650. J. C. Adelung ⁸ confirms that he was commonly called Hans Hungar.

We may now pass from documents connected with Hunyades' personal circumstances to those revealing his technical and chemical interests.

Further information appears in MS. Aubrey 26 which is a 4to volume entitled *Faber Fortunae*, by Aubrey R.S.S. There is much internal evidence showing that the earliest parts of this MS. were written after 1671. It contains Aubrey's notes of (more or less fantastic) methods that he devised for retrieving his fortunes.

'Mr. Huniades' occurs in several paragraphs. In one passage (f. 10) he is called 'Mr. Jo : Huniades'.

The following extracts are a complete transcript of all passages relating to him.

It is interesting to note that Aubrey writes of Huniades as if he were alive. One has to infer that the notes relating to Huniades were copied from earlier notes taken before 1649. Aubrey seems to have known Huniades between 1646 and 1649. In 1646 Aubrey became a student at the Middle Temple, at the age of 20. He left London before 1650.

⁶ MS. Wood, F.39, ff. 92-92v. The same passages occur in a memorandum in Sir Thomas Browne's hand which is found in MS. Ashm. 1788, ff. 151-152. Ashmole has noted at the end " Rec^d 29 March, 1674, 4H : P : M : from Dr. Browne, of Norwich, directed to Mr. Ashmole".

⁷ Anthony Wood (*Athenae*, ed. Bliss, vol. iv, col. 288) repeats this story word for word in his article on Arthur Dee. He adds : " Thus far the worthy Sir Tho. Brown, . . . ". It seems that Ashmole communicated Sir Thomas's memorandum to Wood. Wood's account and the engravings were the sources of later writers, e.g. Wesszprem, *Stephanus, Succincta Medicorum Hungariae et Transilvaniae Biographia*, Lipsiae, 1774-84, vol. i, pp. 12, 13; Granger's *Biographical History*, Part II, p. 434.

⁸ J. C. Adelung, *Fortsetzung und Ergänzungen zu Christian Gottlieb Jöchers allgemeinem Gelehrten-Lexicon*, Leipzig, 1784, vol. i, col. 1397.

f. 4 :

“ Mr. Huniades tells me, that at the Savoy-glasse house, they make their Glasse with Pitt-coal.”

“ Mr. Huniades Secret of making the Raven-black-dye, with Vitriol of Iron : and Mr. Becker tells me, that if I could find out a Roman Vitriol worke, or Mine ; it would be much more profitable to me than Nitre.”

f. 5^v :

“ The curious blew, azure Clay, for Pottery and Porcellane, and casting of ——— at Verknell by Easton-Piers.

Mr. Huniads sth that no clay will cast well.

To make Lattin Mr. Huniades and Mr. Hooke can find out the way that makes the Tinne stick to the Iron. This would be a vast profit.”

f. 6 :

“ Mr Huniades saies, that if one went to Hungarie, there be Mountaines of Gold mines, where one might gett as much, or more then the D. of Albemarle gott by y^e Treasure out of y^e Sea in 1687. qd NB. See Dr Brown's Travells in Hungarie, Servia, &c. with some observations on the Gold, Silver & Copper mines. Mr Huniades comends to me Lex Mercatoria, as to Mines both of Gold, & Silver.”

f. 7 :

“ One told Mr Mdd̄ [i.e. Meredith] Lloyd, that he could extract an ounce and a halfe of Silver out of a pound of lead : sed vix credo : but Mr Huniades told me that he could teach me a way, out of Tinne to gett a crowne a day in my chamber.”

f. 7^v :

“ Desire the Earle of Pembroke to tell me his way of analysing Marchasites ; from the Spaniard.

Mr Huniades bids me carry my Sparre of Flamston-downe to a Refiner in Woodstreet or &c : and they will putt it into a Meltingpott, and tell me what Metall there is. qd. NB. And the same method he bids me use for the Marchasites. He saies the Mock oare (or Marchasites) will come to nothing. and that it is a Cheat put on y^e Earle of Pembroke : but he said, that the smell of it is exceeding dangerous, it being so full of Arsenick. Also he affirmes, that Sparre will not make Glasse :— ”

f. 9^v :

“ Mr Huniades can make a *Dye* not to be erased out. e.g. the Indian way of Dyeing.”

f. 10 :

“ Mr. Jo : Huniades affirmes to me that if he were young, he would goe into Hungarie and doubts not but that he might get an Estate of *two hundred thousand pounds*, by working of the Slagh (i) ⁹ the Cinders, or Refuse of the old Gold-workes. where are vast heapes workt 2000 yeares ago by the Romans : and that but *halfe workt neither* : and he farther doeth affirme, that the Aire doth encrease the Gold. qd. N.B.”

The next paragraph, apparently written at the same time, ends “ now Regnante Gulielmo III ”.

These extracts make it appear that Huniades was not only an alchemist, but generally interested in chemical technology.

In MS. Ashm. 204 (f. 143), we find the following Recipe in the hand of John Booker, the astrologer :

Regulus Antimonij simplex

Take Antimony in lumps 20 oz Tartari Crudi Gallici puluerisati xx oz Salis petri 5 oz misceantur bene Tartar et sal petrus ; tunc pone 6 cochlear' Tart' et Sal' petri in crucibulo then put the Antimony upon it, then put more of the Tartar and salt peter to couer it &c euen till all be mingled & couered wth a tile and at the first but a gentle fyre, after a good ffyre for 2 howers, untill fflores Antimonij appeare & let it looke like water and buble upp : Then set it in a Cold moyst ground till it be cold : Then breake the melting pott and in the bottom you shall finde Regulus Antimonij 6 oz.

fact'. 1623 : 3 Martij : hora meridiana : sub \triangle ☿ ♃ & ♄.

Ascend : per Jo : Huniades.

This would seem to indicate that Huniades, like most alchemists, practised astrology and that he was in England as early as 1623.

Huniades is many times mentioned in MS. Sloane 1139, which consists mainly of a work on *materia medica* by and in the hand of Jonathan Goddard (1617 ?–1675) who was Gresham Professor of Physic in 1655. This work is written round some other texts, which are therefore older. These latter are in two hand-writings. One typical of the mid-seventeenth century is in a reddish ink and makes several references to Huniades ; the other in black ink is partly in Latin and partly in perfectly correct German ; it is a typical German hand of the period. It is conceivable then that this is the autograph of Huniades.

In the reddish ink we find :—

Fol. 1.r.

De Antimonio. Dr. Hunniades hath distilled ex Antimonio sine additione p Retortam in arena a liquor butt very little.

⁹ Short for i.e.

Fol. 12-17 on rectos.

A process for the Spirituall oyle of Succinum don by John Hūyades.

This oil of amber was a well-known medicament even today commended by country-people. The complex recipe is not of sufficient interest to be quoted *in extenso*, but it contains one very interesting feature, namely the use of temperature measurement in distillation :

f. 16.r. We observed yt in stronge boylinge to destill at the first in the 20 degree and at the last in the 40 degree.

f. 18.r. dom Hunniades destilled it in the 6 and 4 degree . . .

We may ask ourselves what sort of thermometer and what scale was used. The early air-thermometers could hardly be used. The sealed alcohol-thermometer dates from 1641, and one of these may have found its way into Hunniades' hands. It is suggested that this is the earliest record of the use of temperature measurement in distillation.

Another note appears to relate to the distillation of spirit of wine :

f. 22.r. Dr. Hunniades late destilled the slightest sort, that of 16 pens a pinte, som gallons of it, he hath of pure spirit of wine, as good as that of 6 sh. some (*space left blank*) of a slighter sort.

All these recipes would seem to indicate that Huniades besides being a professor at Gresham College was interested in or concerned with the technical side of chemistry, manufactures and medicines and that he was working on a fairly large scale, probably producing medicines or materials for such. The recipes touch only slightly on alchemy, the evidence for his practice of which appears chiefly in the inscriptions and figures of the engravings, which may now be considered.

Alchemical work of Hunniades.

The engravings display abundant alchemical symbolism. The Hollar engravings show mathematical instruments on one side and chemical vessels (retort, alembic and curcubite) on the other. Above is a globe or (in I a) armillary sphere, below is a symbol of transmutation compounded from the signs of the seven metals (or planets). The Marshall engraving shows chemical apparatus on both sides, and above a pelican with symbolic figures of Sol, Luna and Mercury as supporters. In each engraving Hunyades holds a piece of apparatus not otherwise recorded but somewhat resembling what Mylius¹⁰ calls a Dyota. It consists of two bulbs, presumably connected, into the upper one of which is sealed a J-shaped tube.

We are told that Hunyades destroyed gold and silver by mercury and reduced them into a mercury by mercury. Did he perhaps do no more than

¹⁰ J. D. Mylius, *Basilica Philosophica*, Frankfurt, 1618, p. 258.

dissolve small quantities of the precious metals in mercury? He then precipitated the mercury without any addition to a red powder in the vessel discussed above. Presumably this means that the mercury was slowly oxidised by keeping the vessel containing it at a temperature near the boiling point of the mercury, the function of the upper bulb and J-tube being perhaps that of a condenser for the vapour. So far we may conjecture, but how this red powder was multiplied in the sublimatories and other vessels on the left of the Marshall engraving can only be relegated to the large catalogue of alchemical enigmas.

Summary of the life of John Banfi-Hunyades.

Born 1576 at Nagy-Banya (Frauenstadt). In England possibly from the age of 47 (1623), but certainly from 1633, to within a few weeks or months before his death. Professor at Gresham College, probably in mathematics. Engaged in various pharmaceutical experiments and manufactures. Painted by Gowy and made the subject of engravings by W. Hollar, 1644, and William Marshall, 1646. Claimed to have succeeded in certain alchemical operations on gold, silver and mercury before the latter date. In contact with William Lilly, John Booker, John Aubrey, Jonathan Goddard and Arthur Dee. Died at Amsterdam in or about 1650.

It might be possible to find out more about Hunyades' origin and early life, if Hungarian sources were accessible. The sepulchral monuments of his family at Klausenburg may have survived, and their inscriptions may indeed contain interesting information.

Three points may be mentioned in the interest of future research :—

1. Matthias Corvinus Hunyades (1443–1490), son of Johannes Hunyad and King of Hungary, was born at Klausenburg. If 'Hunyades' is a patronymic, it may mean that our alchemist was one of this King's descendants.

2. The well-known noble family of the Banffy had two manor houses near and a palace at Klausenburg ¹¹.

3. About 20 miles to the West of Klausenburg, there is a village and a castle called Banffy-Hunyad ¹². It is unlikely that our alchemist derived his name from this place, because he came from Nagy-Banya. The place was probably named after the family who owned it ¹³.

¹¹ Baedeker's *Austria-Hungary*, Leipzig, 1905, p. 405 and adjoining map.

¹² *Ibid.*, p. 376 ; *Grosses vollständiges Universal Lexicon*, Leipzig and Halle, 1735, vol. xiii.

¹³ The authors would wish to express their gratitude to Miss M. Braddock, Stubbins Lea, Chinley; Miss Helen Scott-Eliot, The Royal Library, Windsor Castle; Mrs. Patricia Owen; Dr. C. B. Lageman, University Library, Cologne; Dr. zum Felde, Hamburg.

REVIEWS.

A Source Book in Chemistry 1400-1900. By HENRY M. LEICESTER and HERBERT S. KLINKSTEIN. McGraw-Hill, 1952. Pp. 554+xvi. \$7.50.

THIS work forms a part of a series of Source Books in the History of Science, the value of which to the student of the subject is incontestable, provided that he does not rest content with their extracts. Only a small part of the book comes within the scope of *Ambix*: indeed there seems to be no justification for the date 1400 on the title-page since the earliest extract given is from Biringuccio's *Pirotechnia*, published in 1540. Much might have been quoted from the early distillation books or even from such practical alchemists as Thomas Norton, if it had been desired to begin the book at an earlier epoch.

The extracts concerned with the period before 1700 occupy 58 pages and are well chosen. It might have been better to retranslate some of the extracts rather than to quote English renderings of no great merit. Thus the extract from Paracelsus is quoted from Waite's translation, and the extract from van Helmont is quoted from John Chandler's English translation *Oriatrike or Physick refined*. The book, however, is chiefly concerned with the later history of Chemistry, and it can be heartily commended as a concomitant to the study of a good short history of the subject, such as has been presented by Professor J. R. Partington. F. S. T.

Union Académique Internationale. Katalog der Arabischen Alchemistischen Handschriften Deutschlands: Handschriften der Öffentlichen Wissenschaftlichen Bibliothek (formerly Staatsbibliothek Berlin). Bearbeitet von ALFRED SIGGEL. Akademie-Verlag: Berlin, 1949. Small folio. 144 pp. DM 30.

Union Académique Internationale. Katalog der Arabischen Alchemistischen Handschriften Deutschlands: Handschriften der Ehemals Herzoglichen Bibliothek zu Gotha. Bearbeitet von ALFRED SIGGEL. Akademie-Verlag: Berlin, 1950. Small folio. 118 pp. DM 34,50.

THE compiler of these catalogues, Dr. Siggel, hopes that they will serve as a basis for a future study of the history of chemistry within the consensus of the world of Islam. The plan of the catalogue is as follows:

- (1) The library signature of the manuscript;
- (2) Number of pages, format of the page, description of the writing, number of lines to a page and special characteristics, if any, of the manuscript;
- (3) Title and author; the title in Arabic and a German transcription with a German translation; the name of the author in Arabic and a Latin transcription;
- (4) Incipit;
- (5) Portions of the text that contain references of special interest for the history of chemistry and for the contents of the manuscript, rare chemical terminologies, references to the possible dating of the manuscript and the author, theoretical and philosophical opinions of the author, references to chemical implements and substances;
- (6) Contents of the manuscript;
- (7) References to alchemical authors mentioned in the manuscript;

(8) Mention of very rare chemical substances referred to in this manuscript only ;

(9) References to important chemical implements ;

(10) References to other literary sources that contain subject matter related to the manuscript.

As Dr. Siggel says in his preface, he has endeavoured to follow the directions laid down by the late Professor Ruska in *Archeion*, 1929 (supplement, p. xxix) and in his *Richtlinien*, Berlin, 1936, where it is suggested that those portions of other works, such as philosophic treatises, encyclopaedias, works on magic *et al.*, which are in reality alchemical texts inserted in these works, should be included in any catalogue of Arabic alchemical manuscripts. For this reason Dr. Siggel's catalogues are likely to be of considerable value to the student of alchemical history. It should be added here that the non-Arabic scholar will not be deterred from using these catalogues, as everything of importance to the historian is translated into German. G. H.

Deutsche Akademie Der Wissenschaften zu Berlin Institut für Orientforschung. Veröffentlichung Nr. 1.

Arabisch-Deutsches Wörterbuch der Stoffe aus den drei Naturreichen die in arabischen alchimistischen Handschriften vorkommen, nebst Anhang : Verzeichniss chemischer Geräte. By DR. ALFRED SIGGEL. Akademie-Verlag: Berlin, 1950. Small folio. 100 pp. DM 29,50.

THE contents of this important work are as follows: preface; introduction; literary sources and list of abbreviations; list of the substances of vegetable and animal origin; the mineral substances; list of chemical implements. The name of the substance is given in a Latin transcription followed by the Latin or German translation and, when possible, the Greek source; the Arabic original is given on the right-hand side of the text. The literary source almost always is given.

The sources of this lexicon are the many Arabic alchemical MSS. which Dr. Siggel has examined, as well as certain medical works, notably the work of 'Ali ibn Sahl ibn Rabban at-Tabari, *The Paradise of Wisdom Concerning Medicine*, written about A.D. 850. Leclerc's edition of Ibn al-Baitar: *Gami' al-mufradat* can be assumed as a literary source whenever no other source is given, while the work of many European scholars of note in the field of Oriental learning has been examined and quoted.

In the upper right-hand corner of p. 95, readers of *Ambix* will find the Arabic equivalent of the title of the journal, a name first suggested by Professor J. R. Partington.

Dr. Siggel is to be congratulated on having produced a work for which alchemical historians have been waiting for a very long time. G. H.

1. Deutsche Akademie der Wissenschaften zu Berlin Institut für Orientforschung. Veröffentlichung Nr. 5.

Decknamen in der Arabischen Alchimistischen Literatur. By ALFRED SIGGEL. Akademie-Verlag: Berlin, 1951. Small folio. 55 pp. DM 16,50. Four photographic reproductions of MS. sp. on two sp.

THE contents of this work are as follows: Preface; Abbreviations; Introduction; Purpose and Construction of the "Decknamen"; "Decknamen"

found in the Gotha and Berlin MSS. ; Alphabetical list of the " Decknamen " ; Notes.

Both Ruska and Wiedemann (*Beiträge z. Gesch. d. Nat.* lxxvii, *Sitzungsber. d. Physikal. Med. Sozietät in Erlangen*, vol. 56, 1924) and Holmyard (*Isis*, viii, 1926, pp. 403-26) have written on this subject. Dr. Siggel includes their names in his list in addition to those new ones which he has taken from the Gotha and Berlin Arabic MSS. He distinguishes four groups of names, according to their terminology : (a) names of the planets in Arabic, Hellenistic Greek, Syriac and Persian ; (mention is made of Ruska's article in " Neue Beiträge z. Gesch. d. Chemie " in *Quellen u. Studien z. Gesch. d. Nat. u. d. Med.*, vol. 8, Heft 3/4, 1942 : V. Katalogue der Decknamen.) (b) Using the Arabic ordinal numbers which are in relation to the names of the planets ; (c) Persian words and Greek words in Arabic or Syriac versions ; (d) " Decknamen " which are used to describe the quality of the substance. There is an interesting section of male and female metals, a list of " Decknamen " for chemical implements and a description of the use of " Decknamen " of the " Elixir ".

The student of alchemical texts, especially those of Arabic origin in their Latin versions, will find Dr. Siggel's work of great value ; it is the " Decknamen " that assist in differentiating a mediaeval chemical text from the many neo-Platonic treatises, the purposes of which are entirely different from those which deal openly or " secretly " with physical substances, but which are grouped with the latter, which often serve to obscure their less complicated meaning. For the student of the history of chemistry, Dr. Siggel's list of " Decknamen " greatly facilitates research and it is hoped that the list will be extended.

G. H.

Dizionario di Alchimia e di Chimica Antiquaria. By GINO TESTI. Casa Editrice Mediterranea: Rome, 1950. 201 pp.

THIS interesting work defines in small compass some eight or nine thousand terms used by alchemists and chemists before the period of modern nomenclature. It is clear that the plan of the work forbade the giving of sources or discussion of the definitions. The reviewer found much in the work that he did not know and could not check, but where the entry was within his knowledge it was generally found to be correct, if not, however, always complete. The definition of *kerotakis*, however, gave only the common and not the alchemical sense. The work can be used with some confidence as an aid to alchemical studies. It contains a number of illustrations, some of which may be new to the reader.

F. S. T.

CORRECTION.

In *Ambix*, Vol. iv, Dec. 1949, Nos. 1 and 2, p. 33, n. 101, the sentence " Then brought it to [left blank]. Stows was Secretary . . . " should read " Then brought it to [left blank], who was Secretary . . . "

